

Stations d'épuration des eaux usées en Tunisie :

Evaluation de la biodiversité selon la norme de
performance 6



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Résumé

L'ONAS a engagé des consultants en conseil spécialisés sur les transactions, pour permettre la délégation de l'exploitation et de l'entretien d'un certain nombre d'actifs au secteur privé. L'ONAS a désigné la Société financière internationale (SFI) pour superviser les conseillers en matière de transactions.

Les études entreprises pour soutenir le processus d'appel d'offres ont mis en évidence le fait que certains des sites et/ou des émissaires sont situés dans, ou à proximité, des sites Ramsar, des zones importantes pour la conservation des oiseaux (ZICO) ou des zones clés pour la biodiversité (KBA). Ce rapport répond aux termes de référence de la SFI consistant à évaluer la biodiversité dans les zones de rejet/réutilisation des effluents afin d'obtenir des valeurs indicatives sur la qualité de l'eau des effluents, pour chacune des 15 stations d'épuration des eaux usées, conformément à la norme de performance 6 (PS 6) de la SFI, Conservation de la biodiversité et gestion durable des ressources naturelles vivantes.

Quels sites des STEP sont qualifiés d'habitat essentiel ?

Cinq des quinze sites STEP (les sites eux-mêmes et/ou leurs émissaires) sont documentés comme étant à moins d'un kilomètre d'un habitat critique (HC) : Djerba Aghir, Djerba Ajim, El Hamma, Kerkennah, et Sfax Sud. Cette constatation est fondée sur l'application de la note d'orientation PS6 mise à jour le 15 novembre 2018, qui renforce les seuils pour le critère 3 : le critère PS6 de la SFI, traitant du nombre d'individus d'espèces en rassemblement. De nombreux sites ZICO et Ramsar, proches des stations d'épuration, ont été désignés en grande partie en raison de la présence de plus de 1 % de la population biogéographique ou d'autres volatiles répondant à la définition de "population" d'oiseaux d'eau. Les orientations actualisées limitent l'application du critère 3 aux seuls sites comptant plus de 1 % de la population mondiale, un seuil beaucoup plus difficile à atteindre. Il peut y avoir jusqu'à dix fois plus de différence entre une population biogéographique et une population mondiale dans la zone concernée.

Trois sites, Djerba Aghir, El Hamma et Zarsis, peuvent également être qualifiés d'habitat critique selon le critère 1 (relatif à la présence d'espèces en danger et en danger critique d'extinction) et le critère 2 (relatif à la présence d'espèces dont l'aire de répartition est limitée) mais nécessiteraient des recherches supplémentaires dans le cadre des EIES¹ des sites pour le déterminer. Ces recherches supplémentaires sont recommandées pour El Hamma (avec trois espèces potentiellement préoccupantes) mais ne sont pas recommandées pour Djerba Aghir et Zarsis en raison de la difficulté à confirmer la présence et le nombre de la seule espèce de poisson concernée.

Le domaine d'analyse est-il approprié ?

Ce rapport a appliqué les critères d'habitat critique spécifiquement à la zone immédiate autour de la station d'épuration et de rejet (dans un rayon de 1 km environ) et dans les zones de conservation clés déjà identifiées près des sites (principalement les ZICO et les sites Ramsar). Toutefois, il convient de

¹ Etude des Incidences environnementales et sociales

souligner que lors de la réalisation d'une évaluation complète de l'habitat critique (EHC), il est conseillé d'identifier une "zone d'analyse écologiquement appropriée" détaillée, qui peut parfois se situer au niveau du paysage terrestre ou marin et s'étendre au-delà de la zone d'influence du projet. Il est possible que, si le golfe de Gabès était évalué dans son ensemble, les seuils du critère 1 pourraient être atteints pour toute une série d'espèces marines à large répartition. Nous avons identifié les sites de STEP qui se déversent directement dans le golfe de Gabès, dans des zones qui ne sont actuellement pas identifiées comme HC, mais qui pourraient mériter une réévaluation, si le golfe de Gabès dans son ensemble était considéré comme un habitat critique (Tableau 6).

La ZICO et le site Ramsar de Chott El Djerid, situés à proximité, constituent une unité physiographique distincte ayant des fonctions écosystémiques communes et sont de la même taille que tout le golfe de Gabès. Dans le golfe, cependant, les systèmes Ramsar, ZICO et KBA ont évalué séparément des zones relativement petites et aucune tentative n'a été faite pour évaluer le golfe dans son ensemble.

Il est donc nécessaire que, dans le cadre de l'évaluation des impacts cumulatifs (EIC) du golfe de Gabès spécifiée dans les documents accompagnant les termes de référence, une EHC plus complète soit entreprise pour le golfe.

Les normes actuelles relatives aux effluents sont-elles appropriées pour tous les sites ?

L'étude environnementale supplémentaire détermine quelle norme d'effluent devrait être appliquée aux 15 stations d'épuration, tandis que la présente étude examine, de plus près, l'adéquation de la norme proposée pour les sites adjacents aux éléments sensibles, notamment ceux de la biodiversité. Certaines recommandations ont été formulées pour aider à respecter ces normes dans des cas spécifiques. Quatre sites, pour lesquels un travail supplémentaire sur la biodiversité pourrait être effectué dans le cadre des EIES détaillées (Tableau 6), ont été identifiés. Le site d'El Hamma, où trois espèces des Critères 1 ou 2 semblent être présentes, est préoccupant et l'état actuel du Sebkha Chott Fjej, pour ce qui concerne l'utilisation des oiseaux d'eau, doit être évalué plus en détail.

Les auteurs de ce rapport souscrivent à la plupart des conclusions de l'Étude Environnementale Supplémentaire. Ils reconnaissent que les améliorations apportées aux stations d'épuration amélioreront généralement la qualité des effluents, en particulier pour les paramètres dits traditionnels des STEP municipales (par exemple, DCO, DBO, MES, N, P). Il s'agit d'une hypothèse de base dans cette analyse et elle est considérée comme un aspect positif pour la biodiversité. L'application des différentes mesures améliorera les conditions environnementales et les auteurs du rapport ne pensent pas qu'il soit nécessaire d'appliquer aux sites des normes supplémentaires par rapport à ce qui est proposé.

Qu'en est-il des métaux lourds ?

Il semble aux auteurs de ce rapport que les contrats de partenariat public-privé (PPP) ne prendront en compte que les normes "traditionnelles" de type STEP municipales (DCO, DBO, TSS par exemple). D'autres paramètres, tels que les métaux lourds, spécifiés dans l'ancienne et la nouvelle norme tunisienne

sur les effluents, sont considérés comme ne faisant pas partie des exigences contractuelles du PPP. Il n'existe pas de données sur la qualité actuelle de l'eau des milieux récepteurs, et les analyses chimiques des métaux lourds des effluents ont tendance à être sporadiques. Il n'est donc pas possible, dans le cadre de cette étude, d'aller beaucoup plus loin. Étant donné qu'entre 8 et 10 sites (selon les limites géographiques du Golfe) se déversent dans le Golfe de Gabès, il pourrait être utile de réaliser une évaluation des impacts cumulatifs pour la totalité du Golfe.

Une importance particulière doit être donnée aux métaux lourds au regard de l'élimination des boues. Il n'existe malheureusement pas suffisamment de données pour évaluer les impacts potentiels des différents sites d'élimination sur la biodiversité ou les services écosystémiques. Il conviendrait d'aborder cette question dans les EIES.

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List of Acronyms and Abbreviations

AFFI - Arab Financing Facility for Infrastructure

CIA – cumulative impact assessment

CR – IUCN status code for a species labeled as “Critically Endangered”

DD - IUCN status code for a species labeled as “Data Deficient”

EIA – environmental impact assessment

EN – IUCN status code for a species labeled as “Endangered”

ESIA – environmental and social impact assessment

IBA – Important Bird Area (Important Bird and Biodiversity Area)

IBAT – International Biodiversity Assessment Tool

IFC – International Finance Corporation

IUCN – International Union for the Conservation of Nature

KBA – Key Biodiversity Area

LC – IUCN status code for a species labeled as “Least Concern”

LPO – Ligue de protection des oiseaux

NT – IUCN status code for a species labeled as “Near Threatened”

ONAS – Tunisian *Office National de l’Assainissement* (National Sanitation Office)

PPIAF - Public Private Infrastructure Advisory Facility

PS – Performance standard (IFC)

PS6 – Performance standard 6 of the IFC dealing with biodiversity

STEP – Station d’épuration des eaux usées

VU – IUCN status code for a species labeled as “Vulnerable”

WWTP – Waste water treatment plant

Executive Summary

ONAS hired transaction advisory consultants to enable the delegation of the operation and maintenance of a number of assets to the private sector. ONAS appointed the International Finance Corporation (IFC) to supervise the transaction advisors.

Studies undertaken to support the bidding process highlighted the fact that some of the sites and/or outfalls are located in or nearby Ramsar sites, Important Bird Areas (IBAs) or Key Biodiversity Areas (KBAs). This report responds to a Terms of Reference from IFC to provide a biodiversity assessment in effluent discharge/re-use areas to inform indicative values for effluent water quality for each of the 15 Wastewater Treatment Plants in compliance with IFC Performance Standard 6 (PS 6), Biodiversity Conservation and Sustainable Management of Living Natural Resources.

Which of the WWTP sites qualify as Critical Habitat?

Five of the fifteen WWTP sites (the sites themselves and/or their outfalls) are confirmed within 1 km of Critical Habitat. Djerba Aghir, Djerba Ajim, El Hamma, Kerkennah, and Sfax Sud. This is based on the application of the updated November 15 2018 Guidance Note for PS6 that tightens the thresholds for Criterion 3: the IFC PS6 criterion dealing with numbers of individuals of congregatory species. Many of the IBA and Ramsar sites close to the WWTPs were designated in large part on the presence of over 1% of the biogeographic population or other definitions of “population” of waterbirds. The updated guidance restricts the application of Criterion 3 to only those sites with over 1% of the *global* population, a much more difficult threshold to meet. There may be as much as a ten-fold difference between a biogeographic and a global population within the area concerned.

Three sites, Djerba Aghir, El Hamma, and Zarsis may also qualify as CH for Criterion 1 (dealing with presence of Endangered and Critically Endangered species) and Criterion 2 (dealing with the presence of range-restricted species) but would need further research as part of site ESIs to determine this. This further research is recommended for El Hamma (with three potential species of concern) but is not recommended for Djerba Aghir and Zarsis in view of the difficulty of confirming the presence and numbers of the one fish species involved.

Is the area of analysis appropriate?

This report has applied the Critical Habitat criteria specifically to the immediate area around the WWTP and the discharge (roughly within 1 km) and within key conservation areas already identified near the sites (primarily IBA and Ramsar sites). However, it should be emphasized that when undertaking a full Critical Habitat Assessment (CHA), it is good practice to identify a detailed “ecologically appropriate area of analysis” which can sometimes be at a land or seascape level and extend beyond the area of influence of the project. It is possible that if the Gulf of Gabès was assessed as a whole, the thresholds for Criterion 1 might be met for a variety of wide-ranging marine species. We have identified those WWTP sites that discharge directly into the Gulf of Gabès, in areas that are currently not identified as

CH, but that might merit re-evaluation, if the Gulf of Gabès as a whole were considered Critical Habitat (Table 6).

The nearby Chott El Djerid IBA and Ramsar site encompasses a distinct physiographic unit with common ecosystem functions and is the same size as the whole of the Gulf of Gabès. Within the Gulf, however, the Ramsar, IBA and KBA systems assessed comparatively small areas separately and no attempt was made to assess the Gulf as a whole.

It is therefore required that as part of the Cumulative Impact Assessment (CIA) of the Gulf of Gabès specified in the accompanying Terms of Reference documents, a more complete CHA be undertaken to of the Gulf.

Are the current effluent standards appropriate for all the sites?

The *Etude Environnementale Supplémentaire* considers which effluent standard should be applied to the 15 WWTPs, whereas this study looks more closely at the adequacy of the proposed standard for those sites adjacent to sensitive features, notably biodiversity ones. Some recommendations have been made to help achieve those standards in specific cases. We have identified 4 sites where we feel some additional biodiversity work could be done as part of the detailed ESIA's (Table 6). Of concern is the El Hamma site where we feel three Criterion 1 or 2 species may be present and the current condition of the Sebkhia Chott Fjej in terms of waterbird use needs further evaluation.

We concur with most of the conclusions of the *Etude Environnementale Supplémentaire*. We recognize that the improvements to the WWTPs will generally improve the effluent quality, especially for the so-called traditional municipal WWTP parameters (e.g., COD, BOD, TSS, N, P). This is a basic assumption in this analysis and is considered a positive aspect for biodiversity. The application of the various measures will improve environmental conditions and we do not think that there is a need to apply additional standards to the sites above what is being proposed.

What about heavy metals?

Our understanding is that the PPP contracts will only consider "traditional" municipal WWTP type standards (e.g., COD, BOD, TSS). Other parameters, such as heavy metals, specified in both the old and new Tunisian effluent standard are deemed not to be part of the PPP contractual requirements. There are no data on the current water quality of the receiving environments and the chemical analyses for heavy metals of the effluent tends to be sporadic. Therefore, it is not possible within the context of this study to go much further. Given that between 8-10 (depending on geographic limits of the Gulf) sites drain into the Gulf of Gabès, it might be useful to conduct a Cumulative Impact Analysis for the entire Gulf.

Heavy metals are particularly important with respect to sludge disposal, however there is insufficient data to assess the potential impacts to biodiversity or ecosystem services from the various disposal sites. This would need to be addressed in the ESIA's.

1 Introduction

1.1 Purpose of report

The World Bank is providing technical assistance to the Tunisian National Sanitation Office (*Office National de l'Assainissement*, ONAS) to increase private sector participation in the sector. Funding from the Public Private Infrastructure Advisory Facility (PPIAF) and Arab Financing Facility for Infrastructure (AFFI) helped ONAS hire transaction advisory consultants to structure the first concession contract enabling the delegation of the operation and maintenance of these assets to the private sector. ONAS subsequently appointed the International Finance Corporation (IFC) to supervise the transaction advisors. The pre-qualification has now been successfully concluded, and draft bidding documents and contracts are being finalized.

The PPP contracts will comprise: (i) the delegation of Operation and Maintenance, (ii) the delegation of initial upgrade works (improved treatment), (iii) the delegation of large rehabilitation works, as well as (iv) the delegation of annual major maintenance and renewal works. The assets that will be subject of the PPP contracts include 15 existing wastewater treatment plants (“WWTPs”) that are geographically situated in two regional groups: Sud (14 WWTPs) and Tunis Nord (1 WWTP), see Map 1. The project aims to improve treatment in these existing WWTPs to achieve a positive impact on the receiving environment, however taking into account its assimilative capacity and most sensitive end-use.

To support the bidding process, a number of valuable supporting studies have been completed, see Section 1.2. The findings from these studies highlighted the fact that some of the sites and/or outfalls are located in or nearby Ramsar sites, Important Bird Areas (IBAs) or Key Biodiversity Areas (KBAs). It was decided that a more thorough biodiversity assessment compliant with IFC Performance Standard 6 (PS 6) (Biodiversity Conservation and Sustainable Management of Living Natural Resources) was needed, to further inform the risk assessment for the bidding process.

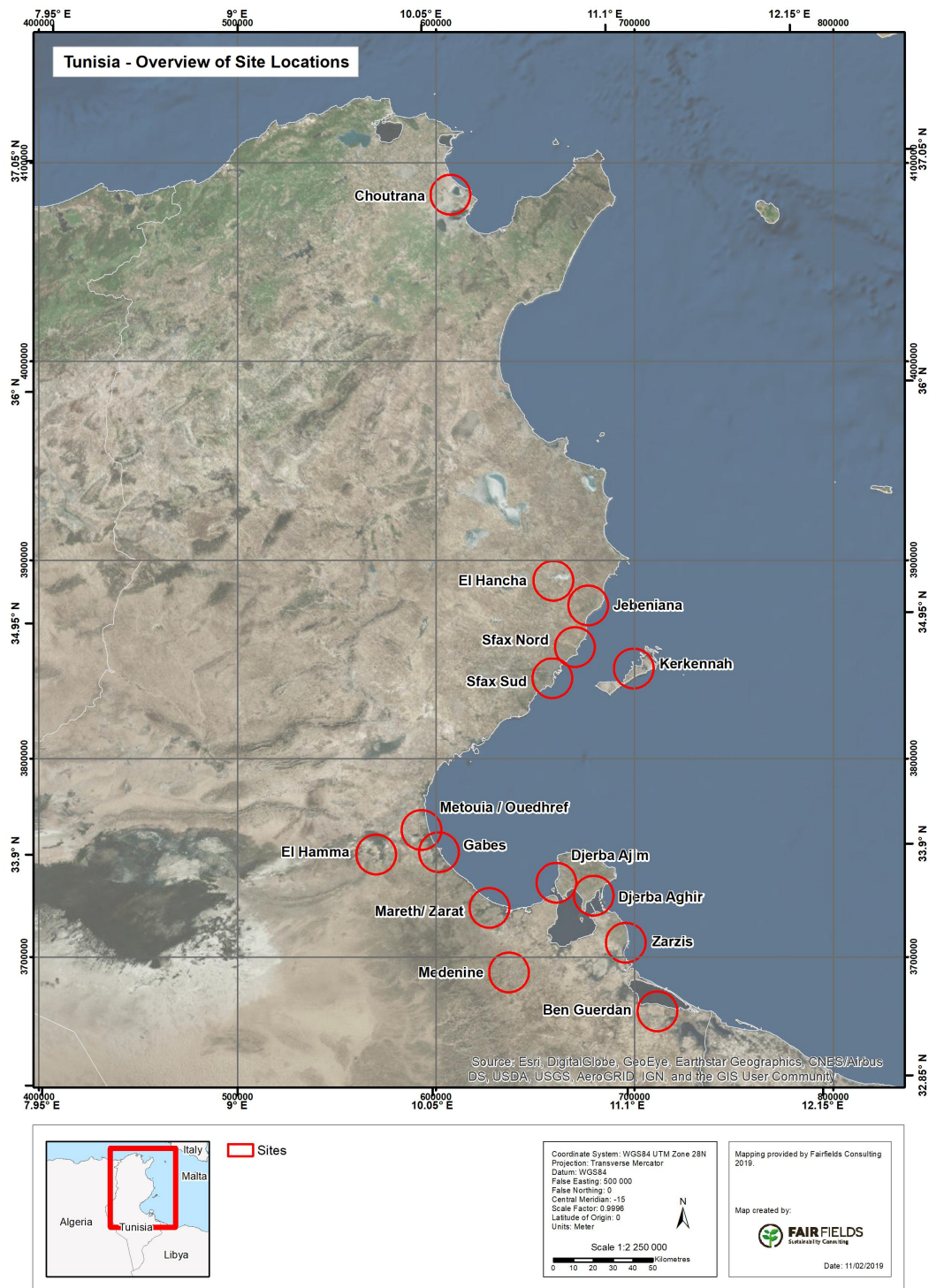
This report responds to a Terms of Reference from IFC to provide a biodiversity assessment in effluent discharge/re-use areas to inform indicative values for effluent water quality for each of 15 WWTPs. The report also provides Terms of Reference for the biodiversity component of the Environmental and Social Impact Assessments that will be conducted for each WWTP by the future winning bidder and for a Cumulative Impact Assessment of the Gulf of Gabès.

1.2 Structure of the report

The report is divided into two volumes. This document is Volume 1. The Executive Summary presents a summary of the report’s findings. Section 1 provides information on the terms of reference for the report, some background information and key findings from existing documents. The introduction is followed in Section 2 with information on relevant standards such as IFC PS 6. Section 3 assesses which biodiversity features might trigger Critical Habitat at the WWTPs. Section 4 presents discussion of key issues and Section 5 a summary of the key findings at each separate WWTP. The references are contained in Section 6. Further detailed analyses for each of the 15 WWTPs and a series of appendices of large tables and other data are presented in a separate Volume 2.

Terms of Reference for site-specific ESIA work and for the Gulf of Gabès CIA are specified in two separate attached documents.

Map 1 Overall map showing location of the 15 WWTPs



1.3 Key findings from existing studies

A number of studies have been completed to support the bidding process. These include: the *Rapport de Due Diligence*, January 2015; an additional note (*Document de Travail: Considérations sur les objectifs de traitement Net P*), November 2016 and a Supplementary Environmental and Social Assessment (*Etude Environnementale Supplémentaire*), draft, May 2018.

In addition, subject to a specific request, Artelia (one of the transaction advisory consultants) provided background data on effluent analyses from 2014 to 2016 (February 13th and 25th 2019). On March 4th, the final version of the *Etude Environnementale Supplémentaire* (dated January 2019) was made available.

The key findings, based on the revised *Etude Environnementale Supplémentaire* are as follows:

- All of the WWTPs discharge effluents that fail to comply with national Tunisian standards (for one or parameters);
- Some of the WWTPs receive industrial effluent comingled with sanitary wastewater as part of the influent stream;
- According to the *Etude Environnementale Supplémentaire*, four of the 15 WWTPs release effluent in potentially environmentally sensitive locations (Djerba Aghir, Kerkennah, Sfax Sud and Gabes);
- Impacts associated with current practices for the disposal of discharge sludge on biodiversity and ecosystem services are difficult to assess due to insufficient information on the amount, quality, and storage conditions of the sludge;
- There are practically no data on the assimilative capacity of the receiving water;
- Not all WWTPs have infrastructure in place that would allow them to meet the national Tunisian standards, and some WWTPs would need significant capex to achieve compliance;
- ONAS proposes to seek exemption from the Ministry of Environment for some of the Tunisian norms. In particular none of the sites would be subject to standards for parameters not considered traditional ones for WWTPs (anything but COD, BOD5, TSS, Kjeldhal nitrogen, total phosphorus, coliform bacteria, fecal streptococcus, salmonella, cholera vibrios and nematode eggs). In addition, those WWTPs that do not currently have disinfection systems would not be subject to the biological parameters.

1.4 Other information consulted

In addition to the documents highlighted above, additional data was gathered from other published reports and online information. This included the Integrated Biodiversity Assessment Tool (IBAT), Ramsar files, Important Bird Area (IBA) files, International Union for Conservation of Nature (IUCN) species status reports and journal articles and reports (some 600 consulted to date). The list of key references is provided in the reference section (Section 6). Additional data came from queries and exchanges with the Artelia staff responsible for the *Etude Environnementale Supplémentaire*.

1.5 Study limitations

This report is a desktop-based study and did not include site visits. No current aerial or satellite images for the WWPT sites were provided, except for those low-resolution images in the *Etude Environnementale Supplémentaire* report. Consequently, the analysis of the habitats around the sites was based on GoogleEarth images that date from 2014 to 2018. In addition, the data used to designate the IBA or Ramsar sites are not very recent. Much of the other published information from Tunisia,

particularly in relation to wintering birds is out of date and the status of these sites may have changed in the intervening period. Lastly data on the water quality in the receiving bodies were not available.

2 Relevant standards

2.1 IFC Performance standards

2.1.1 Modified, Natural and Critical Habitat

Performance Standard 6 requires that certain conditions be met if a project affects Natural or Critical Habitat. Habitat condition is classified as either Natural or Modified based on the extent of human influence on the ecosystem. A Modified habitat includes very disturbed habitats such as agricultural and forestry plantations and urban areas. Natural habitats are areas that comprise species of largely native origin, and where human activity has not fundamentally altered the primary ecological functions. Areas of “high biodiversity value” are termed Critical Habitat by the IFC. The designation is based on the presence of one or more of five main criteria. The determination of Critical Habitat however is not necessarily limited to these criteria. Other recognized high biodiversity values might also support a Critical Habitat designation.

2.1.2 Critical Habitat determination

2.1.2.1 Definition of Critical Habitat

Critical Habitat is defined (IFC 2012, Paragraph 16) as “*areas of Natural and/or Modified Habitat that support high biodiversity value*” based on presence of one or more of the following:

- Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species.
- Criterion 2: Endemic and/or restricted-range species.
- Criterion 3: Globally significant concentrations of migratory and/or congregatory species.
- Criterion 4: Highly threatened and/or unique ecosystems.
- Criterion 5: Areas associated with key evolutionary processes.

The presence of any one of these types of biodiversity feature (sometimes referred to as “Critical Habitat Qualifying Features”) in an area may “trigger” a determination of Critical Habitat. Legally Protected Areas and Internationally Recognized Areas may also qualify an area as Critical Habitat and additional criteria may be used as appropriate, based on expert opinion.

For Criteria 1 to 3, PS6 has established quantitative thresholds that can be used to confirm presence of Critical Habitat. These have recently been amended and the ones presented in this report are based on Guidance Note 6 (GN6) revisions in November 2018. For the other Criteria, expert or specialist judgement is used, supported by credible and reliable evidence gained through literature review.

2.1.2.2 Quantitative thresholds

Determining whether an “ecologically appropriate area of analysis” represents Critical Habitat for particular species for Criteria 1,2 and 3, is based on the proportion of their population or range found within that area. Reliable data on population or Area of Occupancy are not available for many species, subspecies and populations. In those cases, Extent of Occurrence (EOO) are used as a proxy. EOO data are obtained from IUCN (2019), and a calculation made for each candidate species, subspecies or

subpopulation under Criterion 1 or 2 of the percentage of the global and national range within the area of analysis. These percentages are then screened against thresholds within PS6. Thresholds for Critical Habitat qualification under IFC PS6 Criteria 1-3 are provided below. It should be noted that this report is not a Critical Habitat Assessment but only indicates whether the data suggested that certain areas might be.

The thresholds for Criterion 1 are:

- Areas that support globally-important concentrations of an IUCN Red-listed EN or CR species (0.5% of the global population **and** 5 reproductive units of a CR or EN species);
- Areas that support globally-important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR **and** meet the threshold above.
- As appropriate, areas containing nationally/regionally-important concentrations of an IUCN Red-listed EN or CR species.

Analysis is usually carried out on the percentage of the known national range of each of the threatened species found within “ecologically appropriate area of analysis” or “discrete management unit” (DMU).

The thresholds for Criterion 2 are:

- For terrestrial vertebrates and plants, a restricted-range species is defined as those species that have an EOO less than 50,000 km².
- For marine systems, restricted-range species are provisionally being considered those with an EOO of less than 100,000 km².
- For coastal, riverine and other aquatic species in habitats that do not exceed 200 km width at any point (e.g., rivers), restricted range is defined as having a global range less than or equal to 500 km linear geographic span (i.e., the distance between occupied locations furthest apart).
- Areas that regularly hold ≥10% of the global population size **and** ≥10 reproductive units of a species.

The thresholds for Criterion 3 are:

- Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species’ lifecycle.
- Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.

2.1.2.3 Legally Protected and Internationally Recognized Areas

In circumstances where a proposed project is located within a legally protected area or an internationally recognized area, PS 6 requires that the client meet the requirements of paragraphs prescribed for Natural or Critical Habitat as applicable. In addition, the client will demonstrate that the proposed development in such areas is legally permitted, act in a manner consistent with management plans, consult relevant stakeholders and implement additional programs, as appropriate, to promote and enhance the conservation aims and effective management of the area.

2.2 Tunisian effluent standards

The current effluent standard is NT 106.02 (“the old standard”) but it is being replaced by a “new standard”, not yet finalized or applied. A comparison of the two standards and other current standards is given in Volume II Section 3.1. In addition, there is a Tunisian standard dealing with water used for agricultural irrigation, NT 106.03. The new standard is generally less restrictive than the old standard. This is the case notably for BOD₅, COD, TSS, N, P, cadmium, cyanide and mercury.

3 Biodiversity features that could trigger Critical Habitat

We have applied standard IFC Criteria for CH determination, based on the November 2018 Updated Guidance Note for PS6.

3.1 Area of Analysis

As stated previously, this is not a Critical Habitat Assessment (CHA) where a detailed ecologically appropriate areas of analysis has been clearly defined, but an initial CH screening. This report has applied the criteria specifically to the immediate area around the WWTP and the discharge (roughly within 1 km) and within key conservation areas already identified near the sites (primarily IBA and Ramsar sites).

However, there is a larger context for some of the WWTP sites that should be considered. This is the case for the Gulf of Gabès (see Section 3.3.5) and the Chott El Jerid (see Section 3.5.6). Arguably both are exceptional ecosystems, each with unifying characteristics. It could be argued that the entire Gulf and the entire Chott El Jerid could be considered Critical Habitat.

The Gulf of Gabès is shallow and has the greatest tidal amplitude in the Mediterranean, leading to habitats and species of great importance both for biodiversity and ecosystem services. These include extensive mud flats and seagrass beds which form important feeding areas for birds and turtles and feeding and breeding areas for fish. This includes some of the more wide-ranging but highly threatened elasmobranch species such as rays, sharks and skates. The use of a justifiable larger area of analysis may mean that some of these species would have populations above the 1% Criterion 1 threshold within the Gulf. This would potentially affect the assessment for the following WWTPs: Dejerba Akim, Djerba Aghir, Gabes, Jebeniana, Kerkennah, Mareth, Metouia, Sfax Nord, Sfax Sud, and Zarsis.

The Chott El Jerid is a relict landscape with complex underground water resources (artesian wells, hot springs, oases) and species of very limited range. These 'chotts' take the form of depressions or closed basins, which receive water from rain or run-off in wet periods; immediately after rainfall or inflow they may be quite fresh but, following evaporation, they become extremely salty and may dry out completely for long periods. The determination of the complete CHA for the Chott El Jerid area of interest (as required for the El Hamma site ESIA in the site-specific ESIA terms of reference) would potentially affect the assessment for the El Hamma site if the El Hamma region were included in the area of interest because of its hot springs..

3.2 Critical Habitat - Criteria 1 and 2

Species in or near the WWTPs that may trigger Critical Habitat under Criterion 1 and 2 are explored in this section in detail and summarized in Table 1. These include one bird, a reptile, an invertebrate, a crustacean and some restricted range freshwater and marine fish species. IBAT reports were obtained by IFC in 2018 of the Critically Endangered (CR) and Endangered (EN) species (Criterion 1) that could occur within 50 km of the 15 WWTPs. The data obtained are summarized in Volume II Section 3.2. In addition, this section of the report looks at the possible occurrence of restricted range species (Criterion 2).

The IBAT results are often based on very general species distribution maps and require interpretation. The IBAT files produced for the 15 WWTPs identified 40 potential species and 285 possible occurrences (number of species per site times the number of sites). The number of IBAT identified potential species per WWTP range from 1 to 38. The majority of IBAT identified species are marine ones, so the coastal stations have the highest numbers of species.

The IBAT system identified species that ranged in distribution from ones found in only one WWTP to some widespread species found in 14 of the 15 WWTPs. The highest frequency is for *Thorectes puncticollis*, a beetle found over most of the study area.

3.2.1 Flora

Somewhat surprisingly the 7 IBAT plant species (including *Convolvulus durandii* discussed in Section 3.2.9) are all listed only for the Choutrana WWTP. These species all have a restricted distribution within northern Tunisia but extending west into Algeria and Morocco. It is possible that the occurrences of rare plants in Tunisia are indeed concentrated in the northern coastal and mountain areas. It is also possible that not all of the species in Tunisia have been evaluated and that the concentration in northern Tunisia is related to more intensive work in that area. Given that Choutrana WWTP is located in a built-up area next to Tunis, the chances of these species being present appears low.

3.2.2 Widespread marine species

Of the 40 species on the IBAT listing, some 20 are far-ranging marine species (coral, fish, marine turtles, birds and whales), sometimes of near worldwide occurrence. Based on their very large ranges and the absence of any indication of unusual concentrations in Tunisian waters, it appears unlikely that these wide-ranging species would meet Criterion 1 thresholds near the WWTP outfalls. The possible exception to this is if the Gulf of Gabès was assessed as a whole.

3.2.3 Terrestrial invertebrates

Three terrestrial invertebrates are on the IBAT list. Two are listed only for the Choutrana WWTP: *Calopteryx exul* the Glittering demoiselle (EN) and the beetle *Neomarius gandolphii* (EN).

The glittering demoiselle has a very fragmented distribution in North Africa and has suffered from drying of streams and pollution. They appear to be concentrated in mountain streams and the nearest known former sites for the Choutrana WWTP are approximately 50 km away and the closest site with an existing population considerably further. So Choutrana is unlikely to be CH for this species.

Neomarius gandolphii is unusual in that it occurs naturally only in Algeria. Its presence in a few sites in Tunisia is related to trading in wood. Hence for Tunisia it is an introduced species and it is doubtful whether it should be considered a possible Criterion 1 species in Tunisia.

The third species, the beetle *Thorectes puncticollis* (EN), occurs in sandy soils largely in coastal areas of Tunisia and is potentially present at all of the WWTPs except for Medenine. Although its geographic

range covers nearly half of Tunisia and smaller parts of Algeria, the number of stations where it is actually found is very limited, and the total area of occupancy (AOO range) is estimated at 60km² or less. The current known locations of *Thorectes* are not near any of the WWTP sites.

3.2.4 Freshwater invertebrates

Only one species fits under this category. It is not listed in the IBAT report and has no IUCN status. This is *Thermosbaena mirabilis*, a small crustacean found only in the hot springs of El Hamma (see Section 2.2.3.3 in Volume II).

3.2.5 Restricted range marine fish

Pomatoschistus tortonesei, Tortonese's goby (EN), is a marine fish with a range restricted to a few areas along the coast of Tunisia, adjacent Libya and Sicily. It is listed by IBAT as within 50 km from the Ben Guerdan, Chourana and Djerba Aghir WWTPs. There is a small disjunct population east of Djerba Island and along the coast to Zarsis and therefore, although not flagged in the IBAT report, Zarsis WWTP is also a potential concern. The species is "a demersal species that is restricted to lagoons, brackish to slightly hypersaline, in shallows on sand near seagrass meadows, particularly *Zostera* seagrass beds. It feeds on small crustaceans and gastropods." (Herler et al 2014).

3.2.6 Freshwater fish

Freshwater fish as a group are of high potential concern because unlike the marine fish, they tend to be of much more limited range and their habitats easily affected. There are three species listed.

One is not on the IBAT list because it has an IUCN status of Data Deficient (DD): *Luciobarbus antinorii* or *Barbus antinorii*. It is restricted to the artesian wells of the Chott el Djerid in southern Tunisia. Fourteen individuals were collected at Fatnassa en Nefaoua in 1989. Since then there have been attempts to locate the population again but without any success. It is thought that the lowering of the artesian water levels and other impacts may have wiped out the population. It is possible that this artesian fish, along with perhaps other undescribed species of the artesian system, may have become extinct.

Haplochromis desfontainii (EN) is a freshwater fish restricted to parts of Tunisia and adjacent Algeria with only 5 known locations. Its natural habitats are freshwater springs, irrigated lands, and canals and ditches. It prefers warm water. The main area of concern is Chott Djerid although it is potentially of concern for 4 of the WWTPs. A 2006 survey found the species to be extirpated from one of the locations, Gafsa and almost extirpated from Tozeur (Schrami, 2010). The survey did not find the species in potential sites near Nefta or south of Chott Djerid, many of which were heavily impacted by water abstraction and canalisation. It has a combined area of occupancy of less than 500 km², it is severely threatened by water abstraction for irrigating date plantations which is leading to a continuing decline in the species. More survey work in the WWTP specific ESIA for El Hamma is required to see if the species is still extant in its previously recorded sites and present in potential new sites, especially south of Chott Djerid and Algeria.

Pseudophoxinus punicus (EN) is another freshwater fish of limited Tunisian-Algerian range. It is listed as potential only for Choutrana WWTP. In Tunisia it is only found in three areas in mountainous terrain. It is not likely to be present at Choutrana WWTP.

3.2.7 Reptiles

Aside from the wide-ranging marine turtles, the only reptile species listed is *Acanthodactylus blanci*, Blanc's fringe-toed lizard (EN). This species is known from coastal, and some inland, regions of northern Tunisia. This is yet another northern species listed as potential only for the Choutrana WWTP.

3.2.8 Birds

One of the listed bird species is possibly extinct as there are no recent sightings: *Numenius tenuirostris*, the Slender-billed curlew (CR). This species used to be considered the most common curlew along the Tunisian coast until recently, but it has suffered a catastrophic decline, possibly because of conditions in its Central Asian breeding grounds. Unless there was a new sighting near one of the coastal WWTPs, past occurrences of this species would not trigger Criterion 1.

Several of the bird species are of very broad occurrence and would likely not trigger Criterion 1 thresholds near the WWTPs: *Falco cherrug*, Saker falcon (EN); *Neophron percnopterus*, Egyptian vulture (EN); and *Puffinus mauretanicus*, Balearic shearwater (EN). The Balearic shearwater has a very limited breeding range on the Balearic Islands but ranges broadly at other times through the Western Mediterranean and the Northeast Atlantic.

Oxyura leucocephala, the White-headed duck (EN), also covers a wide range, from the Western Mediterranean to Central Asia. This species has been decreasing and has a fragmented breeding range. The Tunisian population is resident; however, it does concentrate in flocks outside of the breeding season and could trigger Criterion 1.

3.2.9 Species in error

Two species appear to have been cited in error. *Convolvulus durandoi*, the liseron de Durandoi, is given by IBAT as CR but according to the current IUCN listing is Near Threatened (NT). This species had previously (2010) been considered CR by IUCN but the most current evaluation (Vela et al 2018) assigns it a status of NT given new sightings and recognition of possible confusion with *C. arvensis*. Therefore, this species is not considered a possible Criterion 1 species for the WWTPs.

Geronticus eremita, the northern bald ibis is an EN not CR species and the basis for including Tunisia in its range appears in error. Since 1994 this species has been considered CR, but the latest IUCN evaluation puts it as EN (Birdlife International 2018) following conservation actions in Morocco and captive breeding. It is unclear why it is listed as potential species for the WWTPs. Historically this species may well have been found throughout North Africa, but it was also then found as far north as the German Alps. Today it is listed by country by IUCN as:

- **Native:** Eritrea; Jordan; Morocco; Saudi Arabia; Syrian Arab Republic; Yemen

- **Possibly extinct:** Iraq
- **Regionally extinct:** Ethiopia; Israel; Senegal; Sudan; Switzerland
- **Reintroduced:** Turkey
- **Vagrant:** Algeria; Cabo Verde; Germany; Mali; Mauritania; Montenegro; Portugal; Serbia; Somalia; Spain; Western Sahara

Tunisia is not mentioned, nor is it within either nesting, migrating or wintering ranges for this species on the latest IUCN map. A further search of possible recent data sources failed to elicit any basis for including the species. Therefore, this species is not considered a possible Criterion 1 species for the WWTPs unless a new sighting near the WWTPs was to occur.

3.2.10 Summary of Species that could trigger CH - Criterion 1 and 2

The following table summarizes those species that are of potential PS6 concern for the WWTPs for Criterion 1 and 2.

Table 1 Species of potential concern for the WWTPs

Species	English name	Basis	WWTP sites	Notes
<i>Oxyura leucocephala</i>	White-headed Duck	EN – Criterion 1	Sfax Sud, El Hancha?	Unlikely, would require at least 100 at a site
<i>Acanthodactylus blanci</i>	Blanc's fringe-toed lizard	EN – Criterion 1	Choutrana	Within detailed range map but no known occurrences
<i>Haplochromis desfontainii</i>	Fish with no common name	EN – Criterion 1	Primarily El Hamma	
<i>Pomatoschistus tortonesei</i>	Tortonese's goby	EN – Criterion 1	Djerba Aghir, Zarsis	Marine fish of limited range
<i>Luciobarbus antinorii</i>	Fish with no common name	DD but range-restricted Criterion 2	El Hamma	May be extinct
<i>Thermosbaena mirabilis</i>	Freshwater crustacean of hot springs	Not evaluated by IUCN but restricted to EL Hamma hot springs, Criterion 2	El Hamma	

3.3 Critical Habitat - Criterion 3

The key issue associated with the WWTPs relates to the presence of important bird areas/wetlands. Tunisia has a wide variety of wetlands and many are of considerable importance for birds including natural freshwater lakes, seasonal salt-lakes and pans (sebkhas and chotts), and coastal lagoons/mud flats. The Gulf of Gabès is one of the most important areas for wintering waders in the Mediterranean (regularly holding more than 300,000 waterbirds) due to the large tidal movement (of up to 2 m amplitude) from about Sfax to Ben Guerden creating the only major expanse of tidal mudflats in the entire Mediterranean Sea, apart from the Venice lagoons in Italy. Many sites have been designated as Ramsar sites or Important Bird Areas (IBAs) and some of these trigger Critical Habitat under Criterion 3.

The IFC Critical Habitat Criterion 3 is based on the percentage of the population of congregatory species (essentially birds) present in an area. The PS 6 Guidance Note has recently changed some of the thresholds that trigger Criterion 3. The impact of the application of the new thresholds is that a considerable number of the IBA and Ramsar sites under consideration in this report now no longer meet the definition for Critical Habitat whereas they did before November 2018. It now requires a specific re-assessment of the Criterion 3 thresholds for each site.

3.3.1 Old PS6 Guidance Note

The older guidance note for PS6 (2012) accepted several definitions for this percentage. The basic threshold was 1% of the global population but other thresholds were acceptable:

GN89. The Tier 2 sub-criteria for Criterion 3 are defined as follows:

- Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species' life-cycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment.
- For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance. GN30, GN31
GN30 See IBA global criteria in <http://www.birdlife.org/datazone/info/ibacriteria>
GN31 See http://www.ramsar.org/cda/en/ramsar-about-faqs-what-are-criteria/main/ramsar/1-36-37%5E7726_4000_0
- For species with large but clumped distributions, a provisional threshold is set at ≥ 5 percent of the global population for both terrestrial and marine species.
- Source sites that contribute ≥ 1 percent of the global population of recruits.

Older IBA sites were designated on various interpretations of A4. Many sites were classified based on the A4i criterion that specified 1% or more of a **biogeographic** population. This was particularly the case for much of Africa as many of the IBA determinations were based on the landmark 2001 study by Fishpool and Evans: *Important Bird Areas in Africa and Associated Islands*.

The acceptance of Ramsar criteria 5 and 6 are clear:

“Ramsar Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.

Ramsar Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals **in a population of one species or subspecies** of waterbird.”

3.3.2 Updated Guidance Note (November 2018)

The updated Guidance Note for PS6 (2018) no longer mentions IBA or Ramsar sites:

GN76. Thresholds for Criterion 3 are:

- (a) areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the **global** population of a migratory or congregatory species at any point of the species’ lifecycle.
- (b) areas that predictably support ≥ 10 percent of the global population of a species during periods of environmental stress.

Note that since Ramsar Criterion 5 no longer applies there is no longer any way for large concentrations of many species to meet IFC Criterion 3, unless one or more species meet the 1% global threshold.

In many cases the world and biogeographic populations may be the same, but this is not always so. In the case of the sites in Tunisia, many of the birds in question range not only in the Western Palearctic biogeographic region but also into the Eastern Palearctic and some into the Nearctic. This means that often a 1% for IBA and Ramsar sites might not be 1% for IFC Critical Habitat determination.

3.3.3 Bird species of concern

Table 2 summarizes the 1% global and 1% biogeographic thresholds for the waterbirds species found in largest numbers in Tunisia. The 1% threshold for the global population was calculated very conservatively by using the lower population bound and rounded off. Data on the biogeographic numbers are supplied as available from the IBA and Ramsar reports. The IBA and Ramsar numbers may vary depending on the exact definitions used for their populations.

Table 2 Waterbird species 1% thresholds

Species	World population		Population used for relevant Ramsar & IBA sites		IUCN status
	Total	1%	Total	1%	
Bar-tailed Godwit <i>Limosa lapponica</i>	1,099,000-1,149,000 (IUCN 2017)	11,000		1,200	NT
Black-necked Grebe <i>Podiceps nigricollis</i>	3,900,000-4,200,000 (IUCN 2018)	39,000			LC

Species	World population		Population used for relevant Ramsar & IBA sites		IUCN status
	Total	1%	Total	1%	
Black-tailed Godwit <i>Limosa limosa</i>	614,000-809,000 (IUCN 2017)	6,000		1,700	NT
Collared Pratincole <i>Gareola pratincola</i>	160,000-600,000 (IUCN 2017)	1,600		190	LC
Common Crane (<i>Grus grus</i>)	491,000-503,000 (IUCN 2016)	5,000		900	LC
Common Gull-billed Tern <i>Gelochelidon nilotica</i>	<i>G. nilotica</i> and <i>G. macrotarsa</i> combined is estimated to number c.150,000-420,00 (IUCN 2018)	1,500		130	LC
Common Redshank <i>Tringa totanus</i>	1,300,000-3,100,000 (IUCN 2016)	13,000		2,500	LC
Common Ringed Plover <i>Charadrius hiaticula</i>	415,000-1,400,000 (IUCN 2016)	4,000		730	LC
Common Shelduck <i>Tadorna tadorna</i>	625,000-750,000 (IUCN 2016)	6,000			LC
Common Tern <i>Sterna hirundo</i>	1,600,000-3,600,000 (IUCN 2018)	1,600			LC
Curlew Sandpiper <i>Calidris ferruginea</i>	1,085,000-1,285,000 (IUCN 2017)	10,000		7,400	NT
Dunlin <i>Calidris alpina</i>	4,295,000-6,800,000 (IUCN 2017)	43,000		13,300	LC
Eurasian Curlew <i>Numenius arquata</i>	835,000-1,310,000 (IUCN 2017)	8,000		4,200	NT
Eurasian Oystercatcher <i>Haematopus ostralegus</i>	1,004,000-1,160,000 (IUCN 2017)	10,000		10,200	NT
Eurasian Spoonbill <i>Platalea leucorodia</i>	63,000-65,000 (IUCN 2016)	630		120	LC
Great Cormorant <i>Phalacrocorax carbo</i>	1,400,000-2,100,00 (IUCN 2018)	14,000		3,100	LC
Great White Egret <i>Ardea alba</i>	590,000-2,200,000 (IUCN 2016)	6,000			LC

Species	World population		Population used for relevant Ramsar & IBA sites		IUCN status
	Total	1%	Total	1%	
Greater Flamingo <i>Phoenicopterus roseus</i>	550,000-680,000 (IUCN 2018)	5,500		1000-1250	LC
Grey Heron <i>Ardea cinerea</i>	790,000-3,700,00 (IUCN 2016)	8,000			LC
Grey Plover <i>Pluvialis squatarola</i>	738,000-935,000 (IUCN 2017)	7,000		2,500	LC
Kentish Plover <i>Charadrius alexandrinus</i>	290,000-460,000 (IUCN 2016) very approximate	3,000		660	LC
Little Stint <i>Calidris minuta</i>	1,500,000-1,600,000 (IUCN 2016)	15,000		2,000	LC
Marbled Teal <i>Marmaronetta angustirostris</i>	55,000-61,000 (IUCN 2017)	550		30	VU
Pied Avocet <i>Recurvirostra avosetta</i>	280,000-470,000 (IUCN 2016)	3,000		470	LC
Ruddy Turnstone <i>Arenaria interpres</i>	460,000-730,000 (IUCN 2016)	4,500		1,000	LC
Sandwich Tern <i>Thalasseus sandvicensis</i>	490,000-640,000 (IUCN 2018)	5,000		1,700	LC
Slender-billed Gull <i>Larus genei</i>	310,000-380,000 (IUCN 2018)	3,000		1,800	LC
White-headed Duck <i>Oxyura leucocephala</i>	7,900 to well over 20,000 (IUCN 2017)	80			EN
Yellow-legged Gull <i>Larus michahellis</i>	819,000-1,070,000 (IUCN 2018)	8,000		7,000	LC
Overall number of waterbirds		For IBA and Ramsar over 20,000			

Table 3 identifies species that could trigger CH for Criterion 3 near the WWTP based on the updated 2018 Guidance Note for PS6 and available data on bird numbers from the IBA and Ramsar site listings. This is a conservative list as it is based on numbers in adjacent or nearby IBA and Ramsar sites

Table 3 Species that could trigger CH under Criterion 3 near WWTP sites

Species	English name	Basis	WWTP sites
<i>Larus genei</i>	Slender-billed Gull	Criterion 3	Djerba Ajim, Sfax Sud
<i>Phoenicopterus roseus</i>	Greater Flamingo	Criterion 3	El Hamma, Sfax sud
<i>Platalea leucorodia</i>	Eurasian Spoonbill	Criterion 3	Djerba Aghir, Kerkennah
<i>Marmaronetta angustirostris</i>	Marbled Teal	Criterion 3	El Hamma

3.4 Critical Habitat - Criterion 4

Criterion 4 deals with Highly Threatened or Unique Ecosystems. The IUCN is developing a Red List of ecosystems following an approach similar to the Red List for Threatened Species. The thresholds for Criterion 4 are areas representing $\geq 5\%$ of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN. The Red list has been completed for the Mediterranean that lies within the EU (European Union 2016). Although Tunisia is not in the EU, some of these assessments/habitats could be applicable to Tunisia as they support similar habitats. For example, *Posidonia* seagrass beds in the Mediterranean infralittoral zone, communities of Mediterranean mediolittoral mud and Mediterranean inland salt steppe are all considered (VU). The European Union's Habitat Directive (92/43/CEE) includes *P. oceanica* beds among priority habitats (Habitat Type 1120: *P. oceanica* beds - *Posidonia oceanica*). Seagrass meadows also have a dedicated Action Plan within the framework of the Barcelona Convention, under the "Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean". Many of these priority habitats are considered CH due to the extent of their decline. Further discussion of habitats of potential concern for the WWTPs is given in Section 3.5.5.

3.5 Legally Protected and Internationally Recognized Areas

Most of the areas for which data on aquatic bird concentrations are available are generally identified as IBA and/or Ramsar sites. These sites are considered as Legally Protected and Internationally Recognized Areas under PS6. The Updated GN6 specifically recognizes as Legally Protected and Internationally Recognized Areas: "Exclusively defined as UNESCO Natural World Heritage Sites, UNESCO Man and the Biosphere Reserves, Key Biodiversity Areas, and wetlands designated under the Convention on Wetlands of International Importance (the Ramsar Convention)." KBAs incorporate the IBAs, at least for the ones under consideration in this report.

According to GN6 these sites are either “treated” as CH or Natural Habitat, so at the very least there is a No Net Loss requirement for all IBAs/Ramsar under PS6.

3.5.1 IBA sites

Data on the IBA sites was gathered primarily from the IBA website. Typically, data consisted of a map file and a report file, plus occasionally a supplemental file. Most of the reports date from the time of the original designation (2001 to 2012 primarily) but there are some more recent updates for a few sites.

Table 4 IBA sites relevant to this report

Name of IBA site	Closest WWTP(s)	Notes
Birbane	Zarsis, Ben Guerden	
Bordj Kastil	Djerba Aghir, Djerba Ajim	Confirmed CH
Boughrara	Djerba Ajim	Confirmed CH
Chott Djerid	El Hamma	Confirmed CH
Gourine	Mareth	
Kerkennah	Kerkennah	Confirmed CH
Kneiss	Sfax Sud, Metouia	Confirmed CH
Salines de Thyna	Sfax Sud	Confirmed CH
Sebkhet Dreïaa	Metouia	

3.5.2 Ramsar sites

Data on the Ramsar sites was gathered primarily from the Ramsar website. Typically, data consisted of a map file and a report file, plus occasionally a supplemental file. Most of the reports date from the time of the original designation (2007 to 2010 primarily) but there are some more recent updates for a few sites. The Sections in this report where specific Ramsar sites discussed are indicated in Table 5.

Table 5 Ramsar sites relevant to this report

Name of Ramsar site	Closest WWTP(s)	Notes
Bahiret El Bibane	Zarsis, Ben Guerden	
Chott el Guetayate et Sebkhet Dhreia et Oueds Akarit, Rekhama et Meleh	Metouia	
Chott El Jerid	El Hamma	Confirmed CH
Djerba Bin El Ouedian	Djerba Aghir	
Djerba Guellala	Djerba Ajim	
Djerba Ras Rmel	Djerba Ajim	Not discussed
Golfe de Boughrara	Djerba Aghir	
Iles Kerkennah	Kerkennah	Confirmed CH
Iles Kneiss	Sfax Sud, Metouia	Confirmed CH

Name of Ramsar site	Closest WWTP(s)	Notes
Lagune de Ghar el Melh et Delta de la Mejerda	Chatrouna	
Salines de Thyna	Sfax Sud	Confirmed CH
Sebkhet Oum Ez-Zessar et Sebkhet El Grine	Mareth, Djerba Ajim	

3.5.3 KBA sites

KBA sites were identified in the IBAT report. Unfortunately, there are not enough data on the KBA sites (except when they are simply incorporated IBA sites) to apply IFC criteria to them.

3.5.4 The IBAT site mapping problem

There were considerable discrepancies between the configurations for the IBAs and particularly the Ramsar sites in the IBAT files and the original files on the IBA and Ramsar websites. There are no obvious reasons for these discrepancies. It is possible that the IBAT shapefiles are not labeled correctly. In this report it was decided to rely on the original site definitions on the IBA and Ramsar websites for the assessments. The original IBA and Ramsar maps are shown in Volume II. The maps in this volume (Volume I) were based on the IBAT shapefiles and therefore include some anomalies.

3.5.5 The Gulf of Gabès - a special consideration

Ten of the 15 WWTPs under consideration in this report discharge more or less directly into the Gulf of Gabès. There are five additional WWTPs that are not part of this study that also discharge to the Gulf. The Gulf is an exceptionally important environment that should be considered in its entirety and not solely on the basis of specific WWTP ESIA's or impacts to specific IBAs or Ramsar sites.

The Gulf is considered the most important site in the Mediterranean for migrating and wintering waders. Just at the Kneiss Islands alone there are over 300,000 birds at a time there and at least 19 species are present in numbers over the 1% biogeographic population threshold and 9 species meet the 1% global population threshold (i.e. Criterion 3 for CH). The large tidal amplitude means that large mud flats and seagrass beds are emergent at low tide and become critical feeding grounds for birds and other animals.

The Gulf of Gabès supports the largest *Posidonia oceanica* (seagrass meadows) in the Mediterranean (Ben Mustapha and Hattour 2015). There has been a regression and total disappearance in places of these meadows due to the cumulative effects of discharges into the bay, (Radhouan El Zrelli et al 2017). Seagrass meadows are vital nursery grounds for numerous species.

Three species of marine turtle occur in Tunisia and the Gulf of Gabès. These include the green turtle, *Chelonia mydas* (EN), the leatherback turtle *Dermochelys coriacea* (VU) and Loggerhead *Caretta caretta* (VU) and (LC). The loggerhead is locally common, hence the designation of LC for the Mediterranean population and breeds in several places including the Kerkennah islands, Nabeul, Zarzis and the Kuriat

islands. The leatherback is also common, but sightings of the green turtle are rarer. There is also a wide variety of cetaceans.

The most productive fishing areas in Tunisia are located in the Gulf of Gabès. More than 50-80%², of Tunisia's catch is from the Gulf, although it is increasingly overfished. It is also a vital breeding area for Elasmobranchs which form an important component of Tunisian artisanal fisheries. Sixty-five species have been recorded and at least four highly threatened species use the area as a nursery. The Blackfin Guitarfish, *Glaucostegus cemiculus* (EN), the Common Guitarfish *Rhinobatos rhinobatos* (EN), the Common Smoothhound *Mustelus mustelus* (VU) and Sandbar shark *Carcharhinus plumbeus* (VU). It is possible that these nurseries are Critical Habitat for some elasmobranch species.

The issue of the status of the Gulf of Gabès as a whole, as an exceptional ecosystem, and one threatened by a variety of industries and effluent from 15 WWTPs is complex. Evaluating each WWTP in isolation without considering the combined impact is problematic. For these reasons it would be very helpful if a cumulative impact assessment (CIA) be conducted for the Gulf of Gabès as part of the ESIAs for the WWTPs. Terms of reference for the CIA are included under separate cover.

3.5.6 The Chott El Jerid

The Chott El Jerid IBA and Ramsar site configurations both seem to already recognize the need to incorporate the broader chott and adjacent areas into their configurations. The combined units integrate many of the features that make up this important site.

Although the situation for the Chott El Jerid is similar to the Gulf of Gabès, in that both are large exceptional natural areas, for the Chott El Jerid the authors of the IBA and Ramsar assessments found it acceptable to encompass all of the significant chott area in one unit. Practically this means that the assessment for the current report is simplified because there is a clear basis for considering the chott as a whole and in addition it is only affected by one WWTP. It does raise a question as to why the IBA/Ramsar authors did not use a similar approach for the Gulf of Gabès. Within the context of this report, a complete CHA of the Chott El Jerid area of interest is required as part of the El Hamma site-specific ESIA.

² This figure differs according to the report one reads.

4 Discussion of key issues regarding the assessments

4.1 Preliminary comments about the assessments

The assessments are based on the best available data regarding the WWTPs. Our visual analysis of the sites is based solely on the GoogleEarth images available, typically several years old. Fieldwork was not part of this project. We have no data on the chemical quality of the receiving environment and apparently none exist (Artelia, pers. comm. Feb. 1 2019). Effluent quality data was obtained from Artelia.

4.2 The question of other polluters

In a number of cases, the *Etude Environnementale Supplémentaire* report assesses the impacts from effluent from the WWTPs by placing the effluent in the local context, where there may be other larger polluters (e.g., for the Sfax Sud WWTP). If the larger polluters move or significantly reduce their effluent load, the proportional contributions of the WWTPs could be more significant. For this assessment we have not considered the impact of other polluters in making our recommendations.

For the Gulf of Gabès, 10 of the 15 WWTPs that are part of this study discharge into the Gulf which has obviously suffered greatly from pollution, notably from the Groupe Chimique Tunisien (GCT). According to media in Tunisia there appears to be public pressure to address effluent from these facilities, which may include the closure or moving the most polluting facilities. According to some sources, the Gulf produces 50-80% of Tunisia's marine fish caught for human consumption, although in any case some fish samples are above acceptable thresholds for mercury for human consumption.

It would be preferable to undertake a cumulative assessment of impacts in the Gulf as a whole rather than just undertaking individual impact assessments on each WWTPs.

4.3 The question of heavy metals and other effluent parameters

The *Etude Environnementale Supplémentaire* tends to evaluate effluent almost exclusively for those parameters that municipal WWTPs can handle (e.g., COD, BOD, TSS, N, P). Therefore, there is no detailed evaluation of heavy metal exceedances. The “new” Tunisian effluent standard is considerably more relaxed about most heavy metal guidelines than the former standard. However, the *Etude Environnementale Supplémentaire* takes the position that the PPP contracts for the improvement and management of the WWTPs will not be obliged to meet the “new” standard values for most of the parameters. This was confirmed during a teleconference (Artelia, pers. comm. Feb. 1 2019), and Artelia puts forward that the new managers will only be responsible for meeting the “traditional” parameters and that the WWTPs are designed to alleviate levels for those parameters in the effluents. They argue that levels of other parameters such as heavy metals, must be handled through management of the industrial component that is presumably the main contributor to these levels.

We have produced a summary table of heavy metal exceedances (Annexe 1) based on a review of all the data supplied by Artelia in Annexe 2, of the January 2019 version of the *Etude Environnementale Supplémentaire*. Our final conclusion based on our revised exceedance table is that heavy metals do not

appear to be a major concern. Most of the serious exceedances (over 2x the new standard) were in 2014 and there are fewer serious exceedances later (2015 and 2016). In addition there does not appear to be a pattern of sustained exceedances at a site that would be indicative of a systemic and persistent problem. The decrease in numbers of exceedances from 2014 over so many sites does lead one to wonder if there was a difference in the analytical techniques or laboratories at that point.

However, there is an important caveat to this conclusion. The measurements of heavy metals are infrequent as shown by the blanks in Annexe 1. For example for Metouia / Outheref 2014, 7 of the 25 parameters in the new standard have no measurements at all for 2014. Lack of exceedances must therefore be judged carefully in terms of paucity of data.

5 The site assessments

5.1 Introduction

The location of the 15 WWTPs are shown on Map 1. Each of the 15 WWTP sites have been mapped separately and information provided on the presence of protected areas or designated sites of importance and the reasons provided for their designations are given in Section 2 of Volume II. A desktop assessment of whether the site is potential Critical Habitat has also been included. A list of CR and EN species whose ranges overlap with each of the sites has been provided in Section 3.2 of Volume II. Other information relating to ecosystem services such as nearby fisheries and bathing has also been included where available. Key characteristics of the WWTPs are shown in Section 3.3 of Volume II.

The following sections only give a brief summary of the findings from the detailed assessment in Volume II of this report.

Table 6 identifies some of the major conclusions regarding the WWTPs and discusses some elements common to all of the assessments. The WWTP sites are given in alphabetical order and in the summary by site (Section 5.3).

Table 6 Summary conclusions re the WWTPs

WWTP	Ramsar site or IBA within 1 km of WWTP or outfall	Natural Habitat within 1 km of WWTP / outfall	CH present within 1 km of WWTP / outfall	Discharge to Gulf of Gabès and to be included in the CIA	Additional biodiversity field ESIA studies required by this report	Notes
Ben Guerden		√ / √				Not built yet
Choutrana		/ √				
Djerba Aghir	Ramsar/ IBA	√ / √	√ / √	√		
Djerba Ajim	Ramsar/ IBA	√ / √	/ √	√		Operations started in 2016
El Hamma	IBA	√ / √	/ √		√	
El Hancha		√ / √			√	
Gabes		√ / √		√		
Jebeniana		/ √		√		
Kerkennah	IBA	√ / √	√ / √	√		
Mareth / Zarat		√ / √		√		
Medenine		√ / √				
Metouia / Ouethref		√ / √		√		
Sfax Nord		/ √		√		
Sfax Sud	IBA, Ramsar	√ / √	√ / √	√	√	

WWTP	Ramsar site or IBA within 1 km of WWTP or outfall	Natural Habitat within 1 km of WWTP / outfall	CH present within 1 km of WWTP / outfall	Discharge to Gulf of Gabès and to be included in the CIA	Additional biodiversity field ESIA studies required by this report	Notes
Zarzis Ville		/ √		√		

5.2 Common elements

5.2.1 Improvements to the WWTPs

We recognize that the improvements to the WWTPs will generally improve the effluent quality, especially for the so-called traditional WWTP parameters (e.g., COD, BOD, TSS, N, P). This is a basic assumption in this analysis and is considered a positive aspect for biodiversity.

5.2.2 Applicable standards

The traditional municipal WWTP parameters (COD, BOD5, TSS, Kjeldhal nitrogen, total phosphorus, coliform bacteria, fecal streptococcus, salmonella, cholera vibrios and nematode eggs) are ones that are focused on in the *Etude Environnementale Supplémentaire* and are the ones that the managers of the WWTPs will have to contractually ensure compliance with the current Tunisian standard:

- DBO5 : inférieur à 30mg/l ^[L]_[SEP] (nouvelle norme de 120 à 160 selon le flux)
- DCO : inférieur à 90mg/l ^[L]_[SEP] (nouvelle norme de 30 à 50 selon le flux)
- MES : inférieur à 30mg/l ^[L]_[SEP] (nouvelle norme de 30 à 50 selon le flux)
- L'azote Kjeldhal NK : inférieur à 5 mg/l pour les rejets en DH et inférieur à 30 mg/l pour les rejets en DPM ^[L]_[SEP] (peut-être pas exigible avant le passage de la nouvelle norme)
- Le phosphore total Pt : inférieur à 2mg/l ^[L]_[SEP] (peut-être pas exigible avant le passage de la nouvelle norme) ^[L]_[SEP]
- Coliformes fécaux : NPP par 100 ml inférieur à 2000 ^[L]_[SEP]
- Streptocoques fécaux : NPP par 100 ml inférieur à 1000 ^[L]_[SEP]
- Salmonelles : absence ^[L]_[SEP]
- Vibrions cholériques : absence ^[L]_[SEP]
- Œufs de nématodes intestinaux : moyenne arithmétique inférieure ou égale à 1 pour 1000 ml. ^[L]_[SEP]

Following the adoption by Tunisia of the new standard, the new standards will apply to the WWTPs for those parameters listed above.

However, an exception is that only 8 of the 112 ONAS WWTPs have disinfection systems in place and therefore the *Etude Environnementale Supplémentaire* states that only those stations with those systems in place have to meet the biological standards.

Also, as discussed earlier, compliance to all the other parameters specified in the current and new standard are not considered contractually required by Artelia.

5.2.3 Assumed standard biodiversity work for the ESIAs

It is assumed that all of the WWTP ESIAs will include a comprehensive biodiversity assessment as described in the site-specific ToR (under separate cover).

5.2.4 Additional specified biodiversity work

The specific additional biodiversity work identified in this report has been incorporated in site-specific ToR (under separate cover).

5.2.5 Gulf of Gabès CIA

For all of the WWTPs with discharge to the Gulf of Gabès (see Table 6), it is assumed that if a CIA is undertaken, the conclusions of the assessment (see separate ToR under separate cover) will be considered and applied in terms of the site-specific ESIA as regards impact assessment and mitigation measures, including potentially strengthening the effluent limits.

5.2.6 Determination of Natural Habitat and Modified Habitat

The percentage of Natural Habitat and Modified Habitat around the sites was determined visually on the basis of interpretation of the GoogleEarth images. Since these maps were the only data source available and they are of variable age and quality for the WWTPs, it was not thought useful to conduct a formal GIS mapping exercise. Further evaluation would require a common set of up to date images and field checking.

5.2.7 National and local designations

Mention of national or local designations such as hunting reserves and National Wetlands came from the IBA and Ramsar site evaluations or the *Etude Environnementale Supplémentaire*. The presence of these nationally and locally designated sites would not in and of themselves trigger CH, nor would they qualify as internationally recognized protected area as per PS6 unless they were also recognized as a specific KBA or within an IBA or Ramsar site.

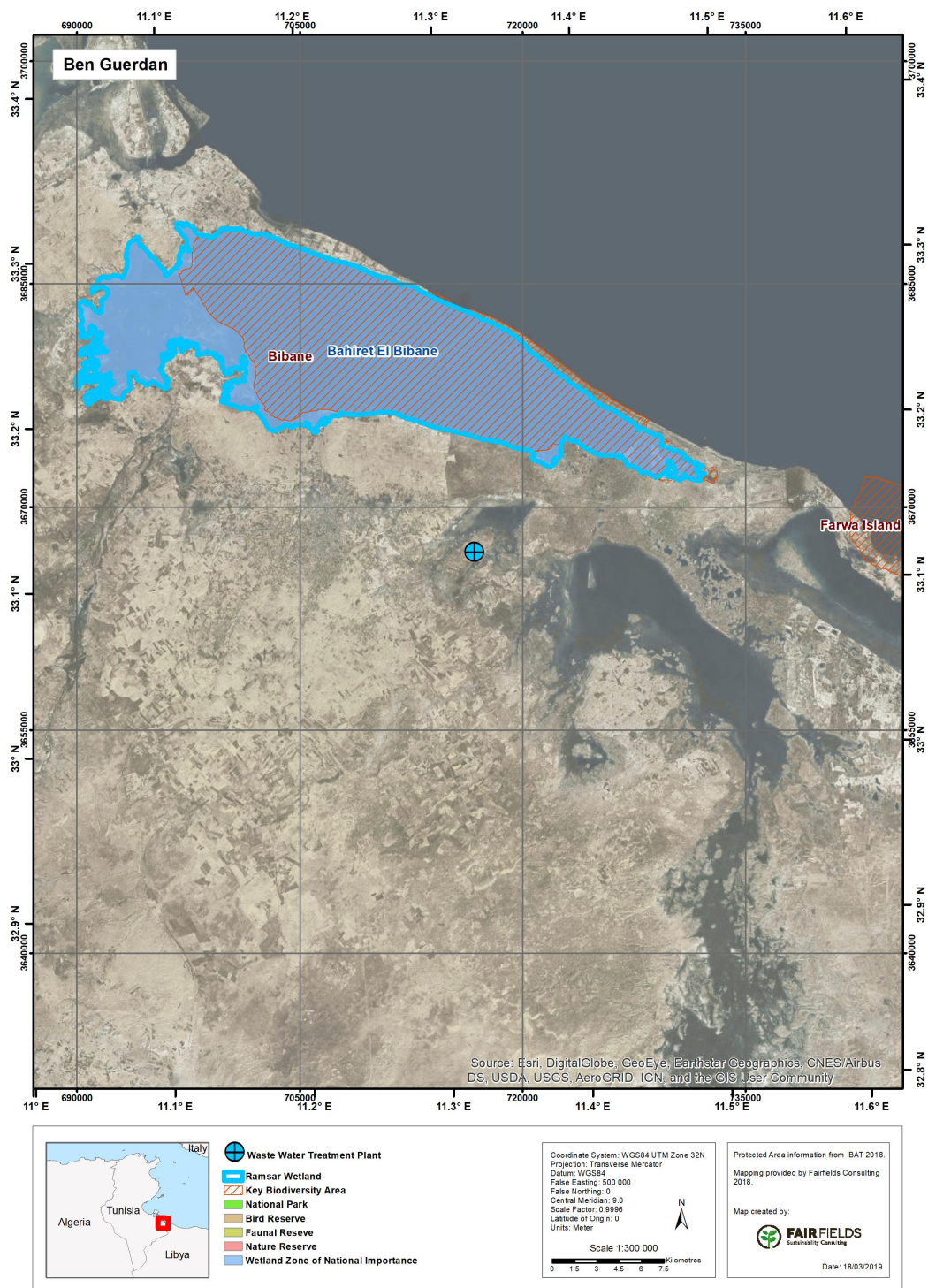
5.2.8 Sludge management

There is little information on the management of the sewage sludge onsite. As the *Etude Environnementale Supplémentaire* states “Le stockage des boues actuellement se fait sur les sites des STEP d’une façon anarchique”. Although there have been several plans and suggestions for dealing positively with the sludge (use in agriculture and in cement plants) and for handling the sludge onsite, little appears to have been done to date.

Current plans call for improvement to the drying beds onsite at Sfax Nord, Sfax Sud, El Hancha and Zarzis Ville, and the construction of additional drying beds at Sfax Sud and Zarzis Ville. The possibility of onsite storage in hangars is proposed but does not seem to have been acted upon. Other forms of waste are handled by taking them to the nearest landfill.

5.3 Summary conclusions per WWTP

5.3.1 Ben Guerden



Ben Guerden is a new WWTP, not yet in operation. According to the *Etude Environnementale Supplémentaire* (January, 2019) it is still under construction. There is therefore no information on the current effluent levels and potential exceedances.

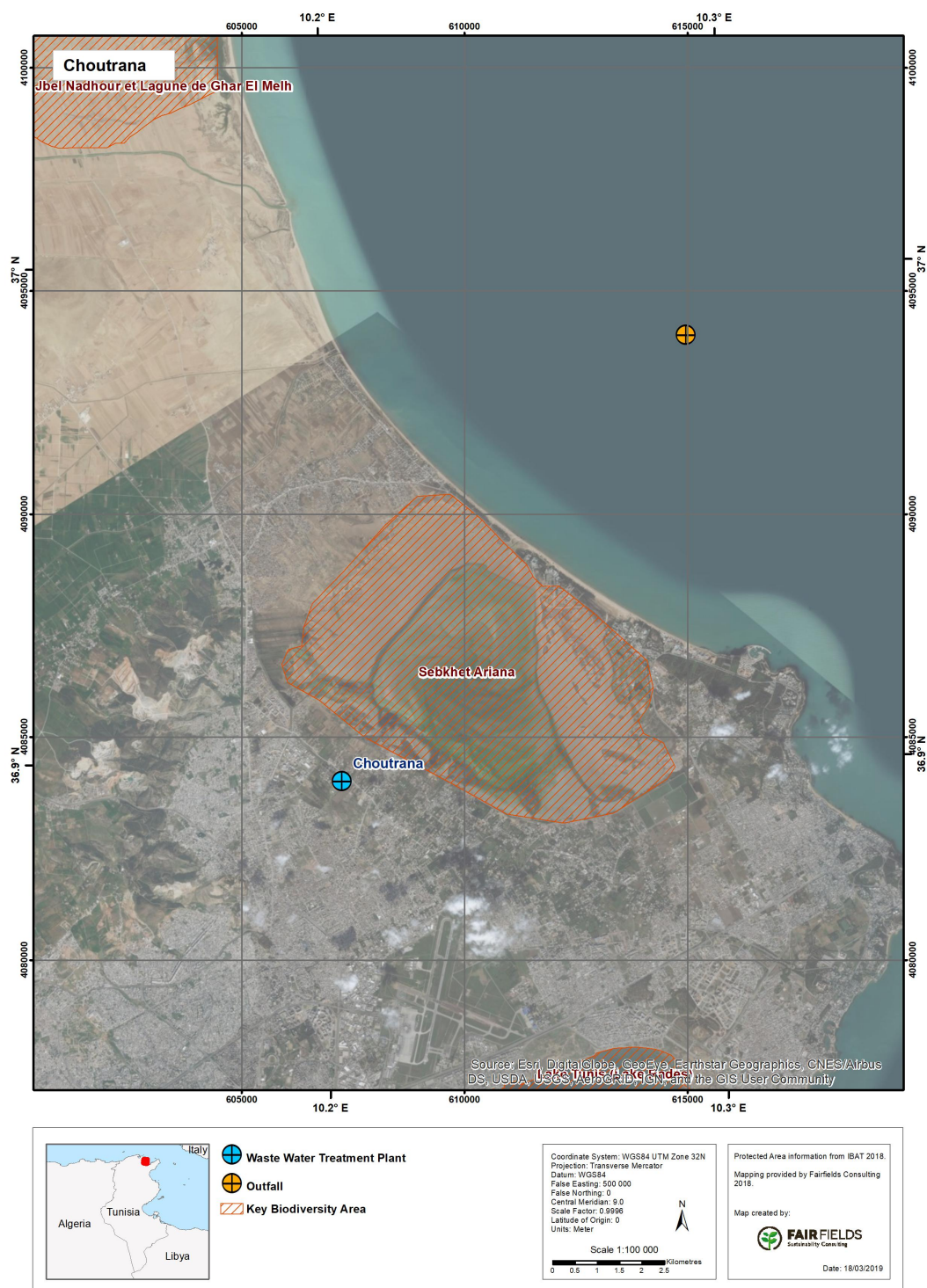
The location of the WWTP is inland and the closest IBA and Ramsar sites are the Bibane sites some 10-20 km to the north. These sites do not have confirmed CH. There is a large sebkhet complex to the east and north, Sebkhet Adhibate, but based on available data, this area cannot be determined as CH.

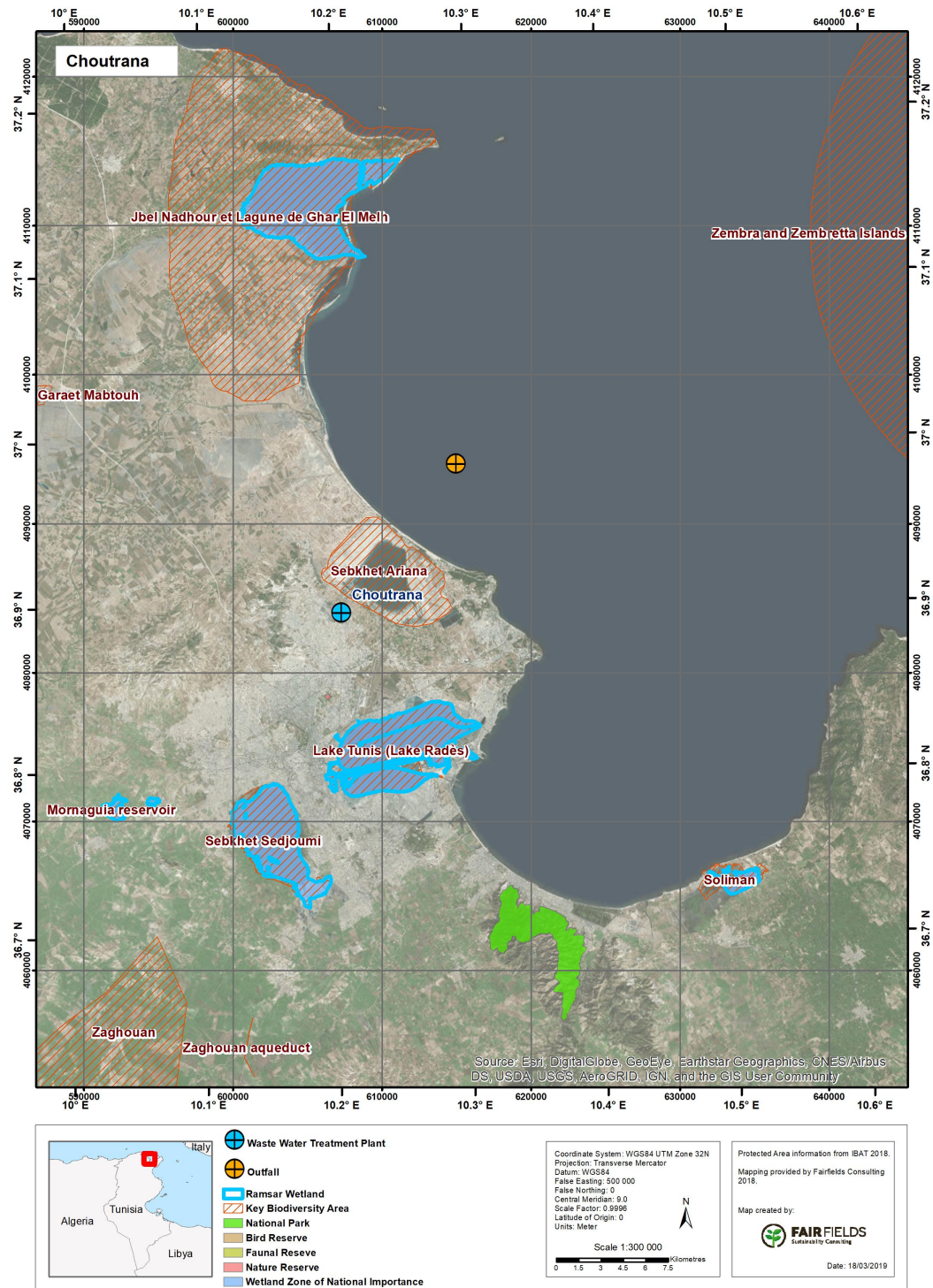
The area around the proposed WWTP site is likely to be mainly Natural Habitat. The discharge is planned somewhere (no specific location determined yet) into Sebkhna Mnikhra, also in Natural Habitat. There are no data available to suggest that this area is likely to be CH.

5.3.1.1 Conclusion

We do not see the need for additional specific biodiversity work as part of the ESIA beyond the normal field surveys and analyses that would always be carried out. The new Tunisian standard appears adequate if all parameters are considered applicable. In this case, since we have no current effluent data, it should be required that the site meet all Tunisian standards not just the traditional municipal sewage ones.

5.3.2 Choutrana





The Choutrana site is a special case. It is the only site out of the 15 being assessed in the Tunis Nord regional ONAS group. Also Choutrana and Sfax Sud are the only two large WWTPs in the set being assessed. Both have hydraulic capacities of 40,000 m³/d or more, considerably larger than some of the WWTPs that just reach a few thousand m³/d. The Choutrana WWTP now has a new discharge point some 6 km out at sea and 20 m deep. This is a significant improvement that will reduce impact on the coastal zone.

There is a Ramsar site to the north (Lagune de Ghar el Melh et Delta de la Mejerda) that comes within 2.5 to 3 km of the part of the coast where the discharge pipe leaves land. There is also a KBA about 1 km to the north of the WWTP (Sebkha Ariana). There is no indication that either of those two sites meets IFC CH criteria.

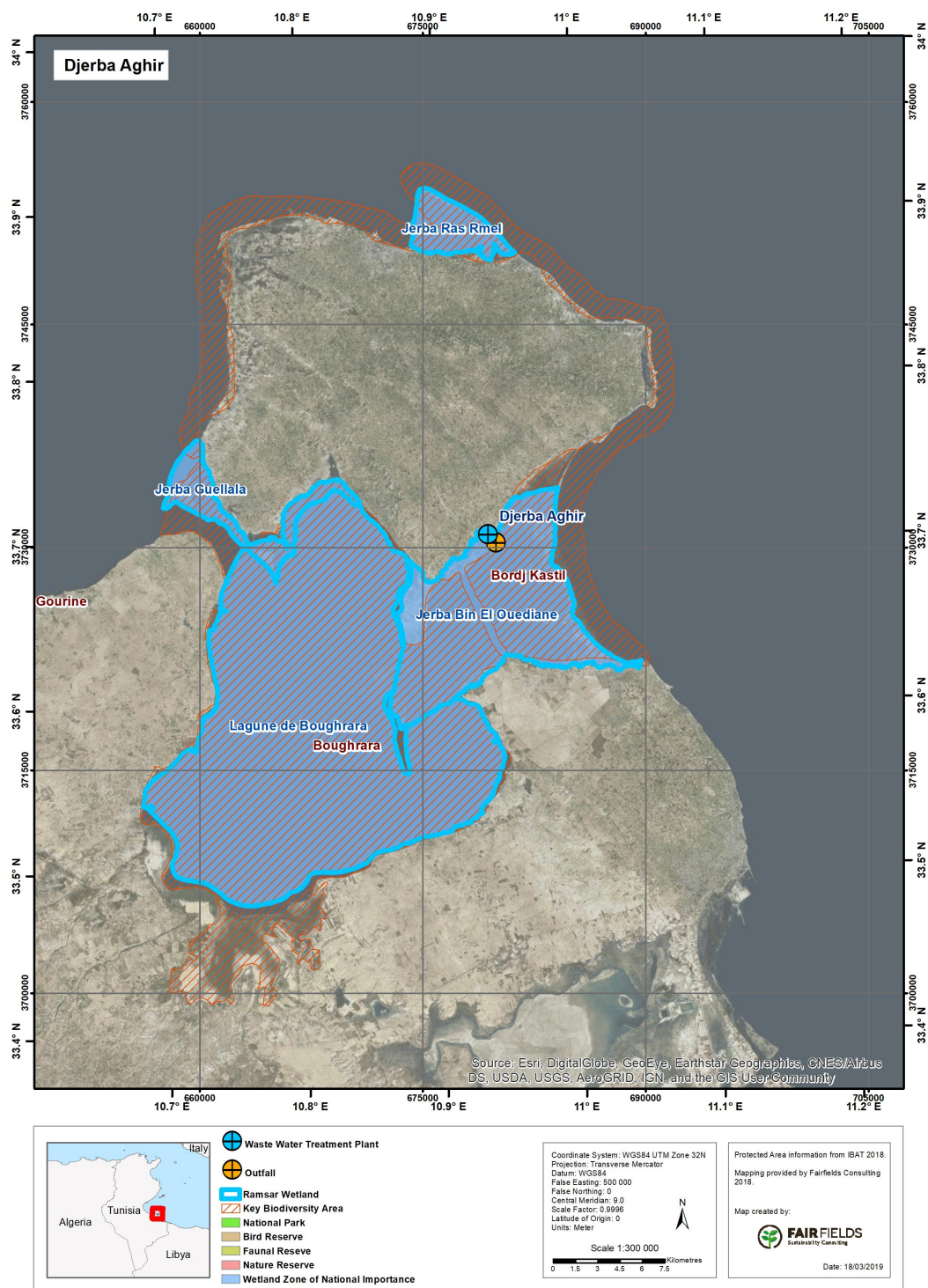
The WWTP is largely Modified Habitat within 1 km. The outfall is now 6 km out at sea and is therefore 100% Natural Habitat within 1 km.

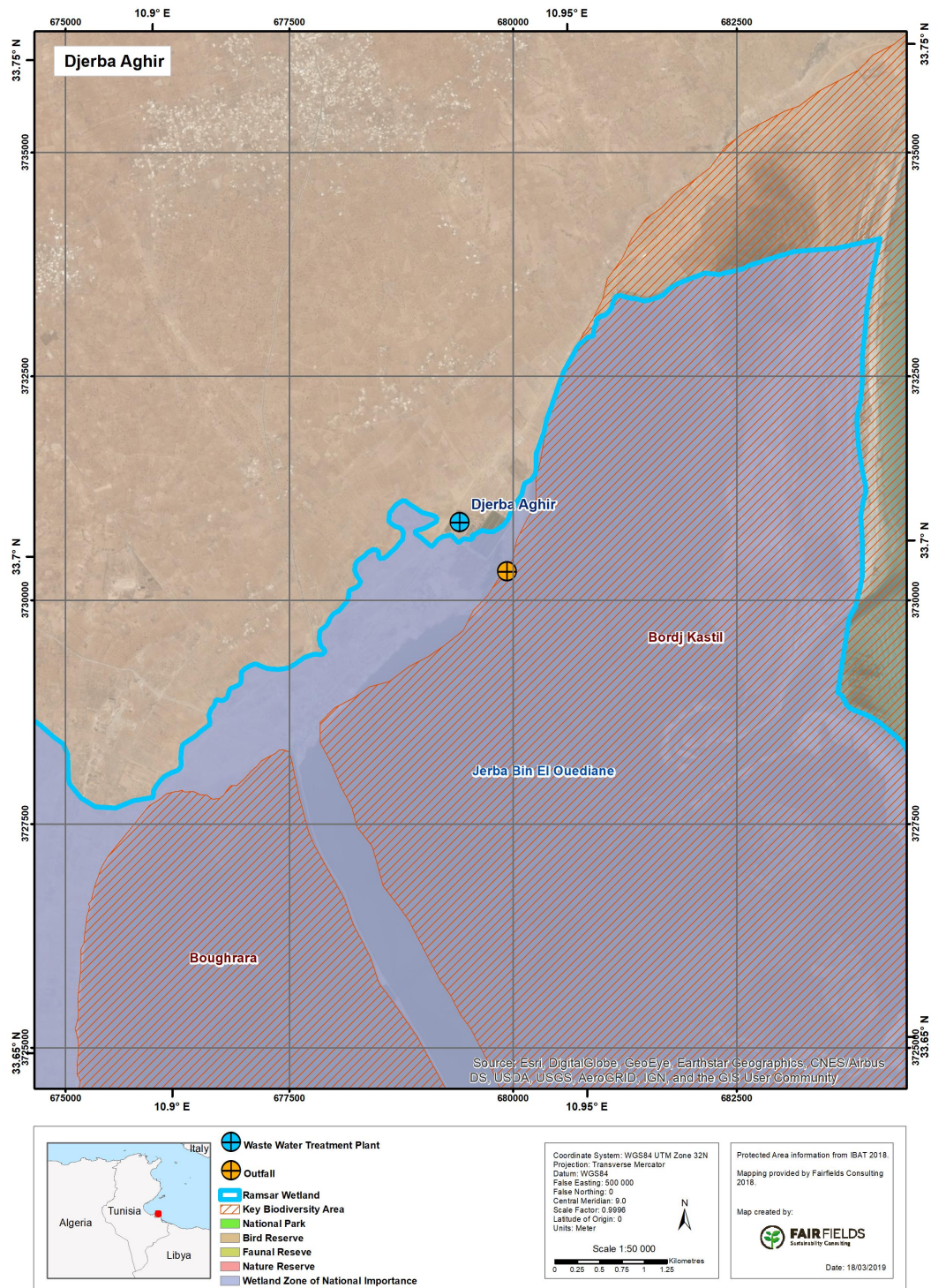
This site has been the subject of considerable work to reduce effluent impacts with recent ESIA's, and with a progressive increase in re-use of effluent for irrigation. The lack of exceedances suggests that heavy metals are not a big problem.

5.3.2.1 Conclusion

We do not see the need for additional specific biodiversity work as part of the ESIA beyond the normal field surveys and analyses that would always be carried out. We also do not see the need for changes to conclusions and approaches recommended in the *Etude Environnementale Supplémentaire*. Particular attention has been paid in that report to the issue of the increased use of irrigation water nearby and standards applicable to the irrigation water (including a 2016 ESIA). We also do not see the need for further consideration of the heavy metals concern for this site.

5.3.3 Djerba Aghir





Djerba Aghir is a medium sized WWTP (about 15,000 m³/d hydraulic capacity) located on the eastern side of Djerba Island. The island is the largest island of North Africa, located in the Gulf of Gabès. It is on Tentative List of UNESCO World Heritage Sites (largely for cultural reasons).

The discharge is at the shore into the waters of Boughrara Lagoon into an IBA (Bordj Kastil) and close to a Ramsar site (Djerba Bin El Ouediane). The WWTP itself is not in an IBA or Ramsar site. The Bordj

Kastil IBA site just barely meets the 1% global threshold for Eurasian Spoonbill at times so can be considered as likely CH.

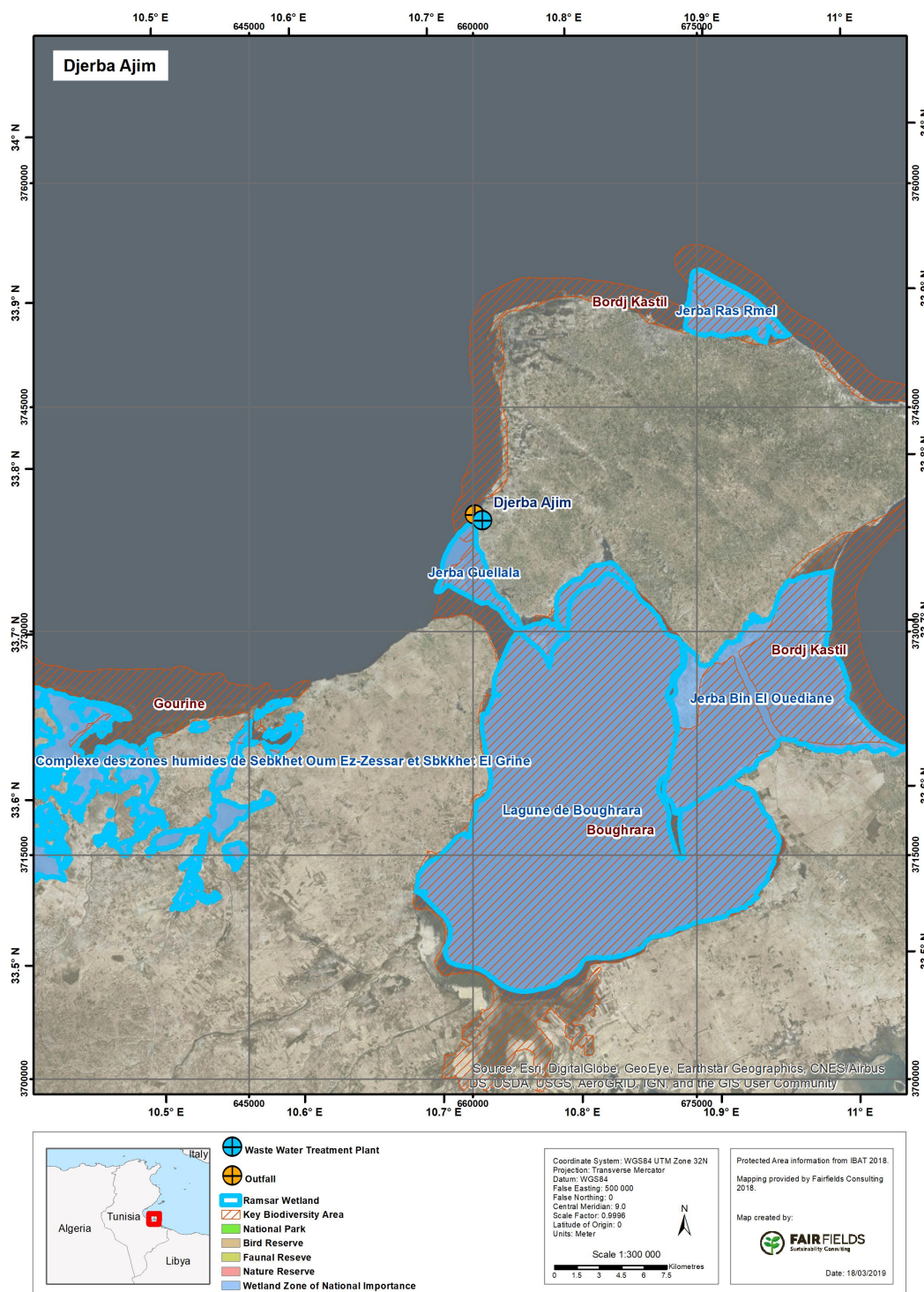
The area within 1 km of the WWTP is mainly Modified Habitat (largely agricultural) but includes some of the adjacent waters and therefore has at least 20% as Critical Habitat. The outfall is near the shore and therefore is roughly 50% Modified Habitat and roughly 50% Critical Habitat. The waters of the lagoon are somewhat enclosed and pollution from various sources is a problem. Fish and other seafood are harvested, in part to supply local tourist restaurants.

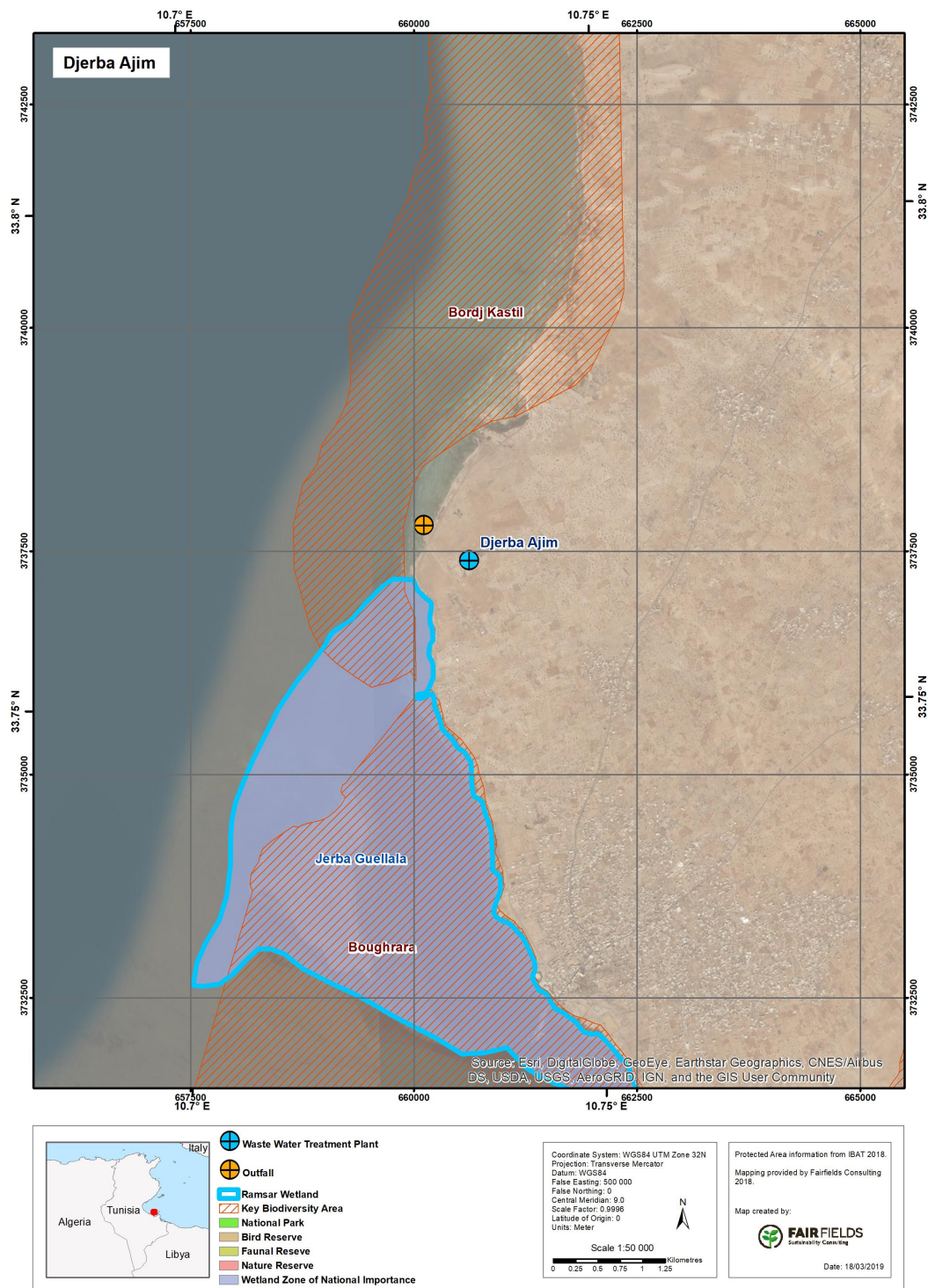
5.3.3.1 Conclusion

While the authors of the *Etude Environnementale Supplémentaire* suggest some approaches to reduce eutrophication in the enclosed lagoon environment, it would be valuable to see some additional consideration of the heavy metal issue. We also think that the proposed reduction of pollutants contributing to eutrophication in the lagoon by an increase in irrigation water reuse must be carefully re-assessed in the WWTP-specific ESIA to ensure that such an approach can yield the results anticipated (e.g., what percentage of the pollution load will be taken up by plants or bound in the soil and not make it back into the lagoon).

The site is also of concern in terms of its impact on the Gulf of Gabès and the CIA will help inform the adequacy of the Tunisian standards in dealing with this site.

5.3.4 Djerba Ajim





Djerba Ajim is a small WWTP (1,950 m³/d hydraulic capacity) located on the western side of Djerba Island. The island is the largest island of North Africa, located in the Gulf of Gabès. It is on Tentative List of UNESCO World Heritage Sites (for largely cultural reasons).

The discharge is 100m out from the shore into the waters of the Gulf of Gabès, and into an IBA (Bordj Kastil) and very close to a Ramsar site (Djerba Guellala) and another IBA site (Boughrara). The WWTP is not itself in an IBA or Ramsar site. The Bordj Kastil IBA site just barely meets the 1% global threshold

for Eurasian Spoonbill at times so can be considered as likely CH. The Boughrara IBA site meets the 1% global threshold for Slender-billed Gull.

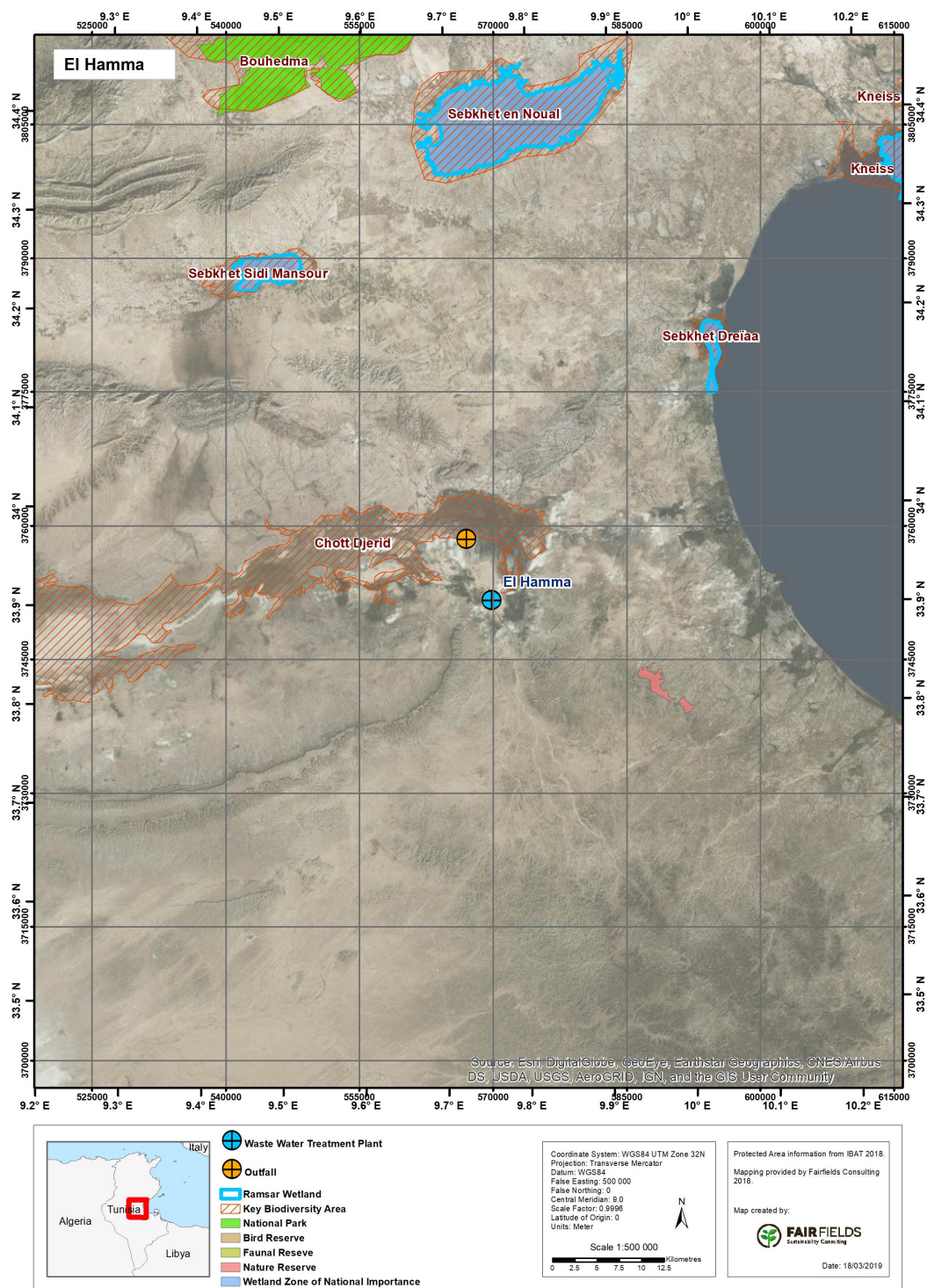
The area within 1 km of the WWTP is partly Modified Habitat (largely residential and agricultural), partly Natural Habitat but includes some of the adjacent shoreline and therefore has at least 10% as Critical Habitat. The outfall is near the shore and therefore is roughly 50% Modified Habitat/Natural Habitat and roughly 50% Critical Habitat within 1 km. Fish and other seafood are harvested, in part to supply local tourist restaurants. There are also bathing beaches nearby.

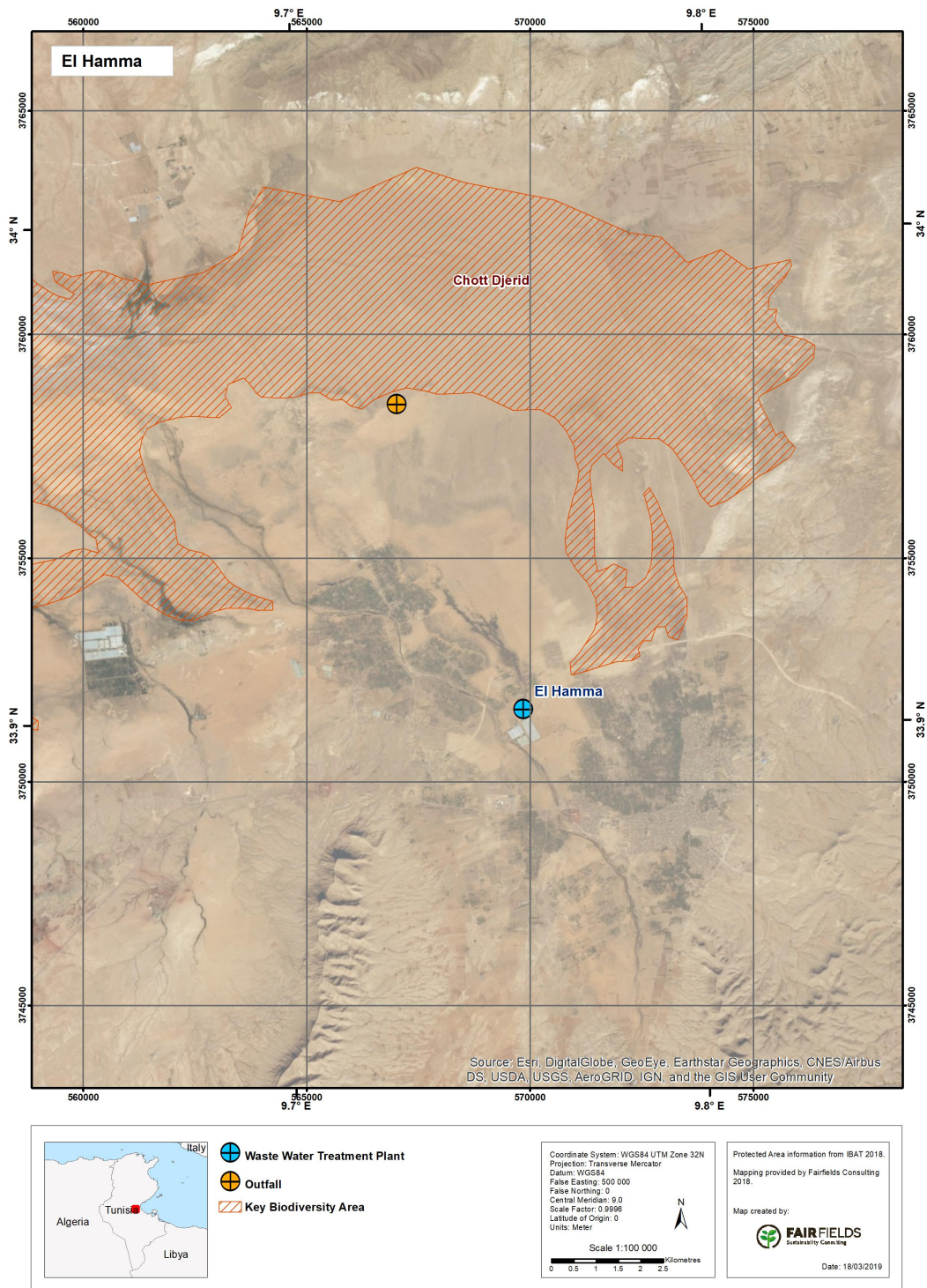
Since the date of the start of the operation at the site was only 2016, it simply means that there are not yet any data on the effluent. The lack of effluent data must be remedied during the site-specific ESIA.

5.3.4.1 Conclusion

The lack of effluent data must be remedied during the site-specific ESIA, especially given the presence of sensitive sites and CH. The site is of concern in terms of its impact on the Gulf of Gabès and it is assumed that a CIA will be carried out that will inform the site-specific ESIA.

5.3.5 El Hamma





The WWTP and outfall is located inland from the Gulf of Gabès (30 km) and on the southern edge of the Chott Djerid (aka Chott El Djerid or El Jerid) and Sebkhah Chott Fjej complex. The Chott Djerid is the largest endorheic basin in North Africa and covers approximately 5,000 km².

The complex is largely groundwater fed and is dry for much of the year with salt crusts precipitating out. In winter when there has been a lot of rain, the area may be largely flooded. Overexploitation of the Complex Terminal Aquifer between 1970 and 2000 has contributed to the loss of the artesian conditions and decline in groundwater. Seasonal surface water flows and return flow from irrigation contributes to the formation of a perched local aquifer.

The WWTP itself is not in a KBA or Ramsar site, although it is just over 1 km from the Chott Djerid IBA site. The habitat next to the WWTP is a mix of Natural Habitat and Modified Habitat (50% Natural and 50% Modified within a 1 km radius). It is located on the edge of a small community and much of the area is in agricultural use. El Hamma is known for its spas, in use since Roman times.

The outfall is surrounded by Natural Habitat and is located on the edge of the Chott Djerid IBA site and the Chott El Jerid Ramsar site is present further west. The IBA site clearly meets the 1% global threshold for Greater Flamingo and the Vulnerable Marbled Teal. In addition, there are three restricted range species potentially present (two fish and one crustacean) that would meet the IFC Criterion 2 threshold:

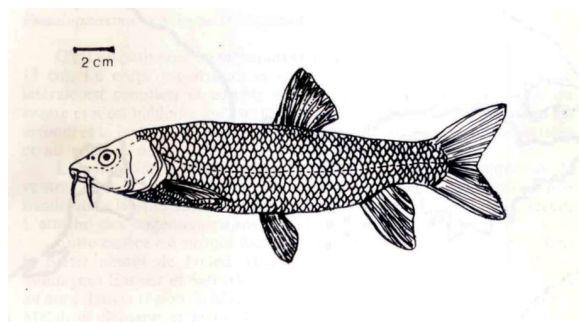
Haplochromis desfontainii

The hypothetical range for the Endangered *Haplochromis desfontainii* includes the WWTP and outfall. The species was first identified from the Chott Djerid area and was only found at five nearby sites. There is little information available on this species and it may be extinct. The habitat includes freshwater springs, irrigated lands and canals and ditches. It has been found in waters as warm as 60 degrees C. Habitat disturbance and water use seem to be the cause for the reduction in numbers of this species.

Luciobarbus antinorii

This is another somewhat mysterious species. It was first described by Boulenger in 1911 as *Barbus antinorii*. It had been found in the artesian waters that the French were then beginning to exploit in North Africa. The original finding was from the Nefzaoua oasis in the Chott Djerid area. Doadrio found 14 specimens in 1989. Further searches by Kraihem (1998) till 1997 proved negative. In 2010 and 2011 Joerg Freyhof also searched for this species and did not find any (<http://joerg-freyhof.de/fieldwork>).

Figure 1 *Barbus antinorii* in Boulenger (1911)

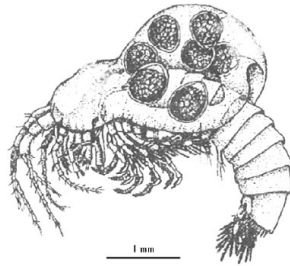


This species is officially listed as DD by IUCN, however given the very limited numbers, if it is extant it would doubtlessly be listed as CR. Also given the very limited range it has been found in, it must also be considered a restricted range species.

Thermosbaena mirabilis

This small crustacean was first described by Mondo in 1924 from the El Hamma hot springs, its only apparent habitat. It is the only species within the family Thermosbaenidae and grouped with three other families in the order Thermosbaenacea.

Figure 2 *Thermosbaena mirabilis* from Barker (1962)



The Thermosbaenacea live in thermal springs in fresh water, brackish water and anchialine habitats. They all have a troglobitic lifestyle, lack visual pigments and are therefore blind. The species has not been assessed by IUCN (as of January 30 2019) but being limited to one set of hot springs and under some threat, it would be likely that it would be considered CR and certainly of restricted range. It is likely that there are other subterranean species of potential biological species that may be present.

The area around the outfall is presumably within Critical Habitat given that two species of wintering waterbirds at least have met the 1% of the world population threshold. Using the precautionary principle, it seems warranted to assume that it continues to have Critical Habitat status.

The two fish and the crustacean species considered above have the potential to trigger Critical Habitat designation, but their status is very uncertain and it is possible that they are now extinct. They will require field checking in the vicinity of the WTP and outfall. The crustacean in the hot springs pose a particular problem. It would certainly seem that anything that could contaminate the subterranean waters of El Hamma, besides being of concern for the continued use of the spas that are a long-established feature of El Hamma, would be of biological concern.

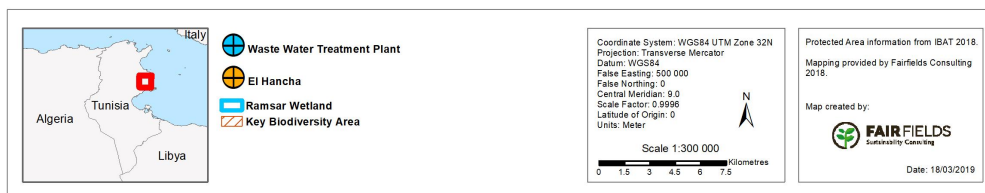
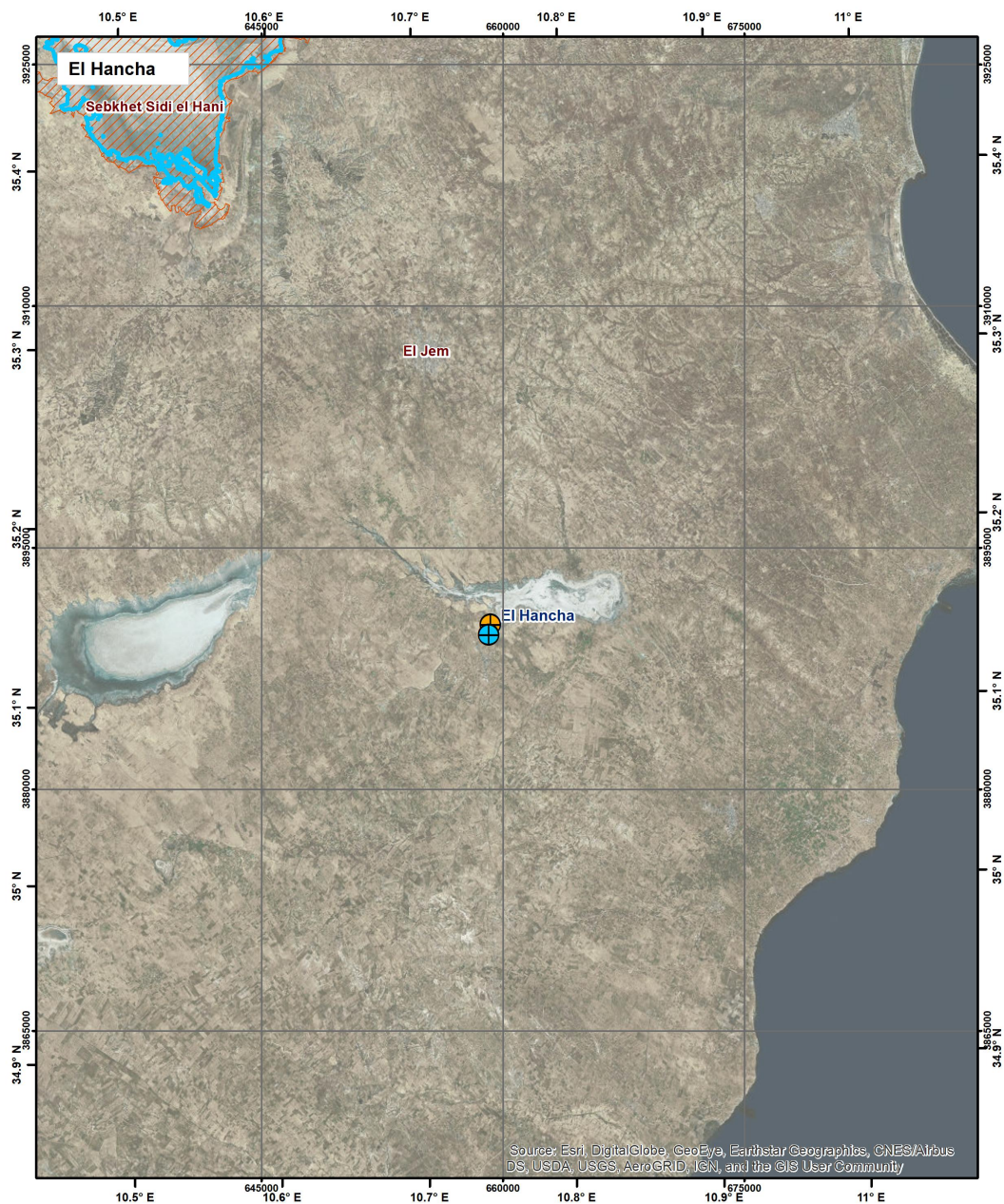
Current effluent values for the three main criteria do not meet the old or new standard with values typically four times above the standard values. The *Etude Environnementale Supplémentaire* report also mentions exceedances for the following parameters under the new standard: chlorides, COD, BOD5, TSS, total Kjeldhal nitrogen, total phosphorus, sulfates, cyanides, mercury, fecal coliforms, and fecal streptococci. The mercury exceedances are in error.

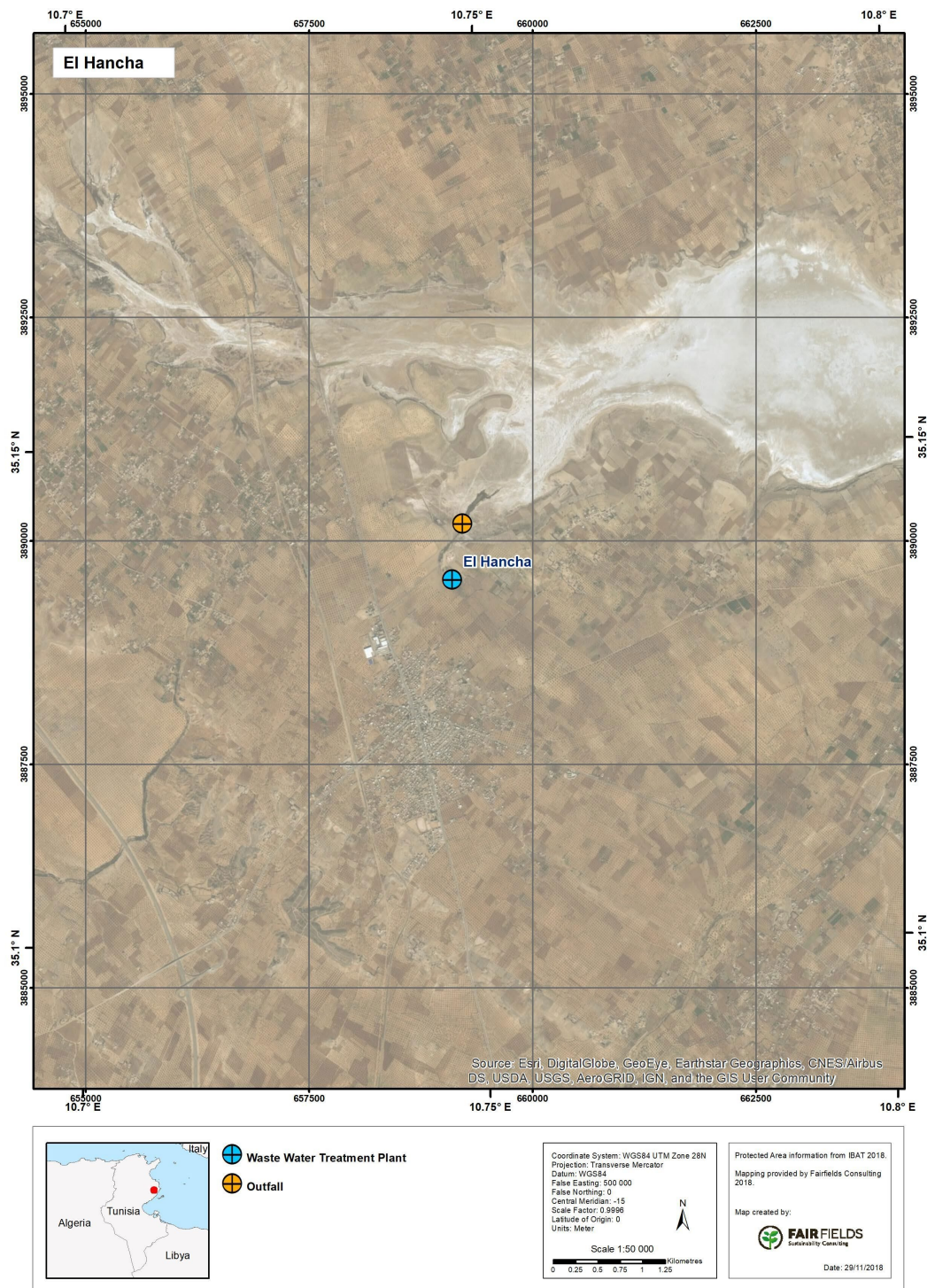
5.3.5.1 Conclusion

The situation in terms of the outfall location is not clear from a biological perspective and the winning bidder will have to undertake the following studies as part of the WWTP-specific ESIA:

- Clarification and documentation of the assumption regarding the drying up of the Sebkha Chott Fjej and its consequences.
- Conduct field surveys checking Sebkha Chott Fjej water levels and bird use. All field surveys must be conducted by competent ornithologists at key times of year;
- Verify the presence or absence of *Haplochromis desfontainii* in canals and ditches near the WWTP and outfall, *Luciobarbus antinorii* in deep wells, and *Thermosbaena mirabilis* in hot springs. Field surveys are to be done by competent specialists;
- Conduct a CHA for the entire Chott El Jerid complex (including the Sebkha Chott Fjej) and including the subterranean water system of oases and hot springs; and
- On the basis of the above data gathered and additional data obtained as part of the ESIA, reevaluate the adequacy of the effluent quality threshold levels to be put in place at this facility. If any of those key species are still present, it may be necessary to consider more restrictive standards.

5.3.6 El Hancha





El Hancha is a very small WWTP (700 m³/d hydraulic capacity) inland site. There are no indications of any IBA or Ramsar sites nearby, nor any sites of recognized importance. The WWTP is in an agricultural area with only about 20% Natural Habitat within 1 km. The outfall is within the Sebkhia El Jem north of the WTTTP and a majority of Natural Habitat.

The only significant biological feature identified is a mention within the *Etude Environnementale Supplémentaire* that there are White-headed Duck in the Sebkhia El Jem. This Endangered species could

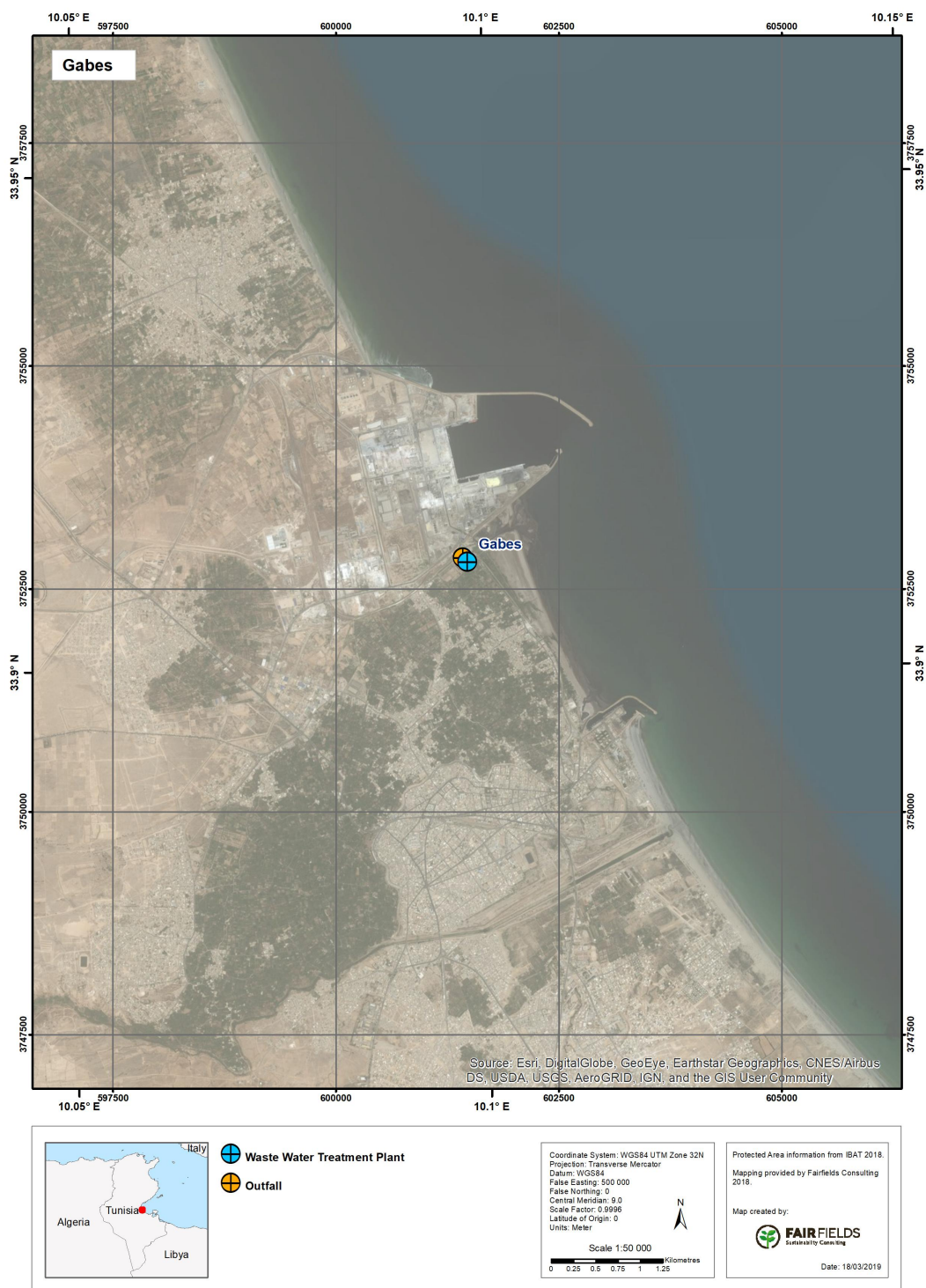
conceivably trigger either IFC Criterion 1 or 3. This is considered very unlikely given the low numbers for this species found at other, better known and perhaps more suitable sites.

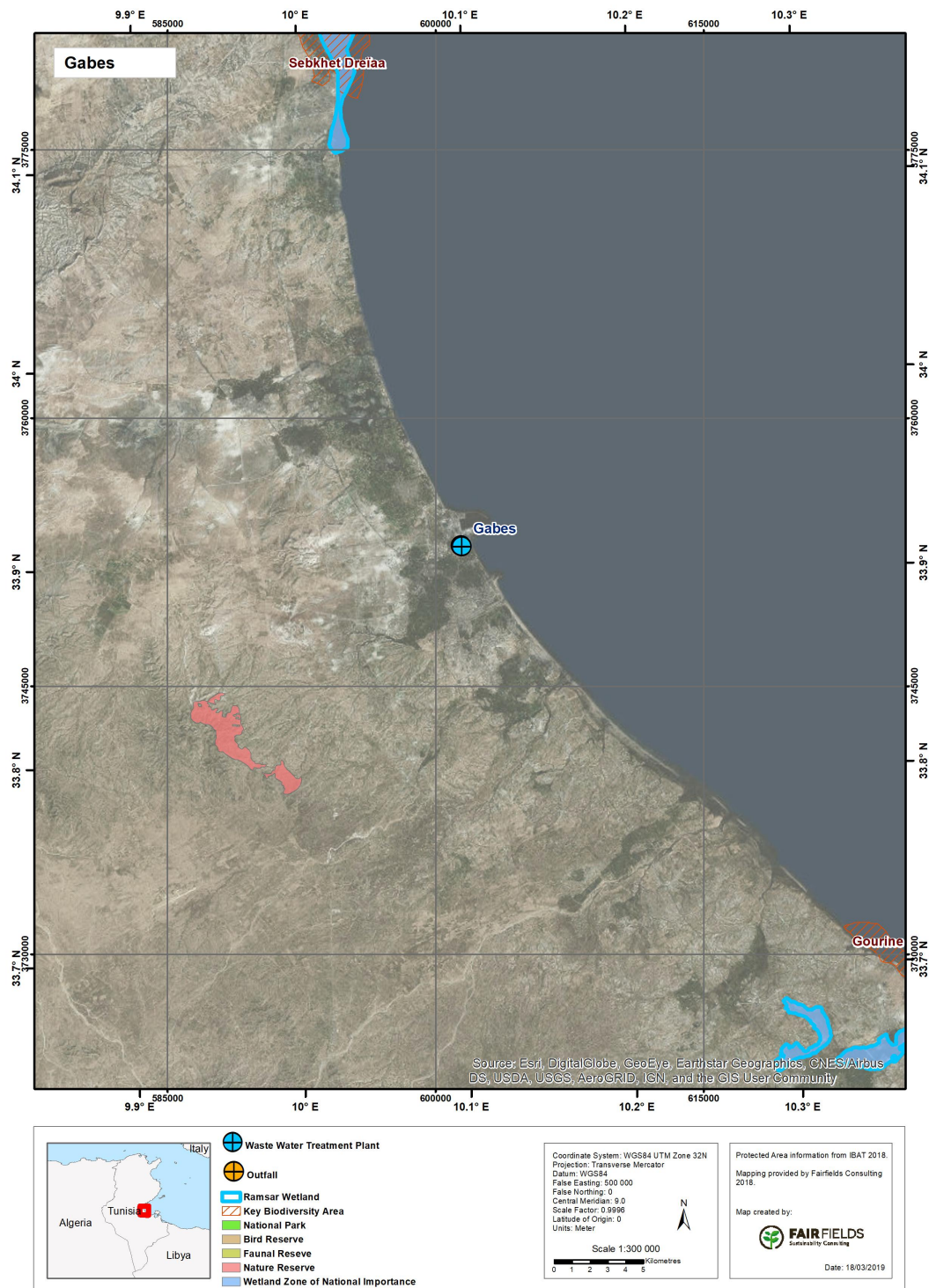
5.3.6.1 Conclusion

The situation in terms of the outfall location is not clear from a biological perspective and the winning bidder will have to undertake the following studies as part of the WWTP-specific ESIA:

- Clarification and documentation of the use of Sebkha El Jem by waterbirds, in particular White-headed Duck.
- Re-assessment of the site if CH is found.

5.3.7 Gabes





Gabes is a medium sized WWTP (17,000 m³/d hydraulic capacity) site that discharges directly into the Gulf of Gabès. There are no indications of any IBA or Ramsar sites nearby, nor any sites of recognized importance.

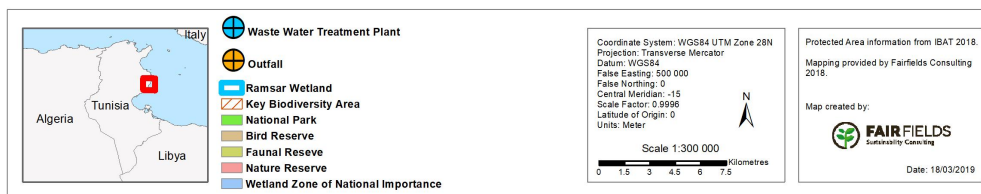
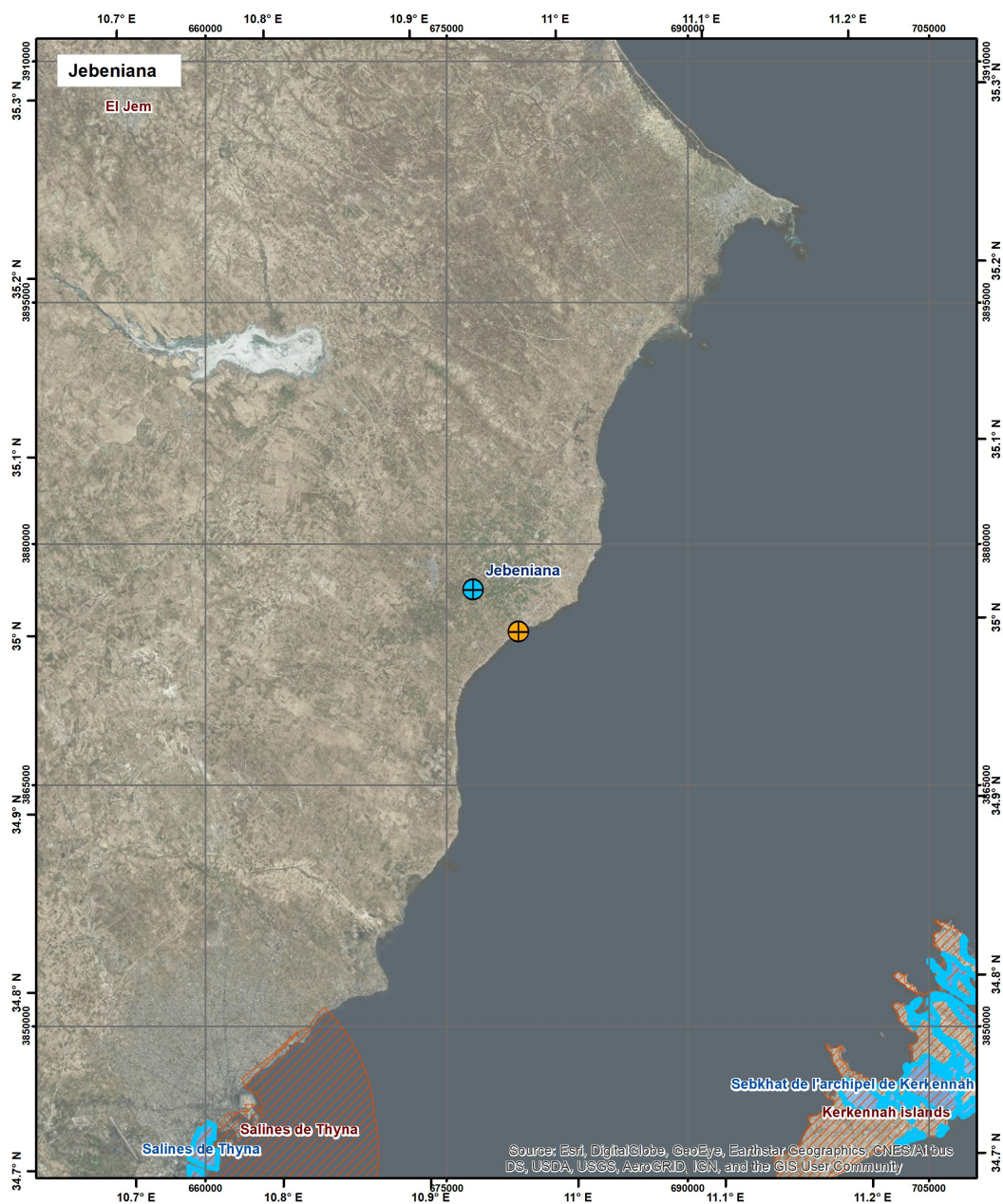
Within 1 km of the WTP, the habitat is primarily Modified Habitat (actually primarily industrial and residential) but because it is close to the shore about 30% is in Natural Habitat. The outfall is slightly closer to the shore and has a somewhat higher percentage of Natural Habitat (40%).

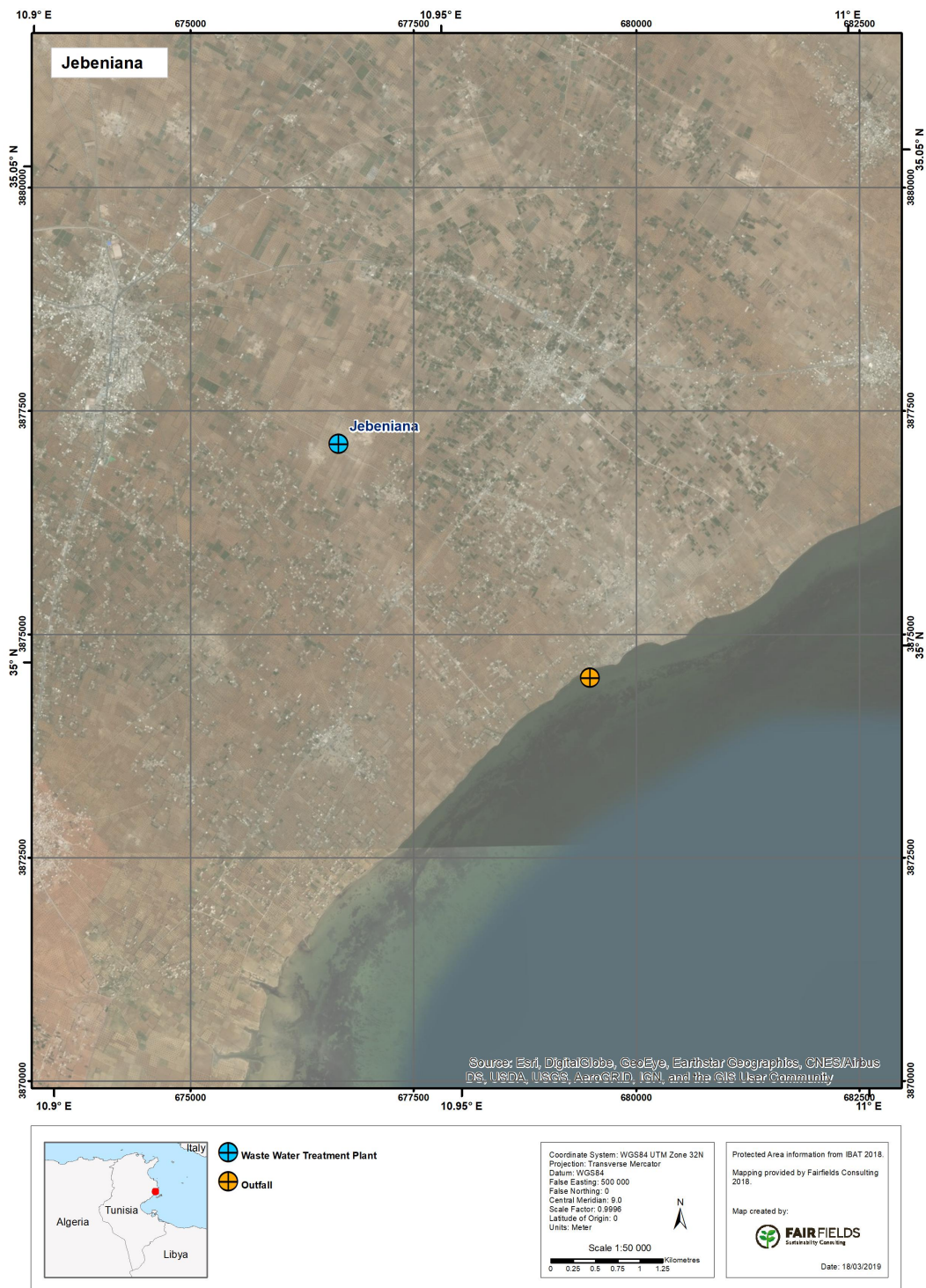
The primary concern is within the overall issue of the Gulf of Gabès and the need to evaluate impacts to the Gulf holistically and cumulatively. The area around the WWTP is heavily industrial and the source of much of the pollution in the Gulf.

5.3.7.1 Conclusion

We do not see the need for additional specific biodiversity work for the ESIA beyond the normal field surveys and analyses that would always be carried out. We also do not see the need for changes to the “traditional” municipal parameter levels of the “new” Tunisian standard. However, the WWTP does not come close to meeting the old or new standards. This is one of the sites to be considered in the CIA for the Gulf of Gabès.

5.3.8 Jebeniana



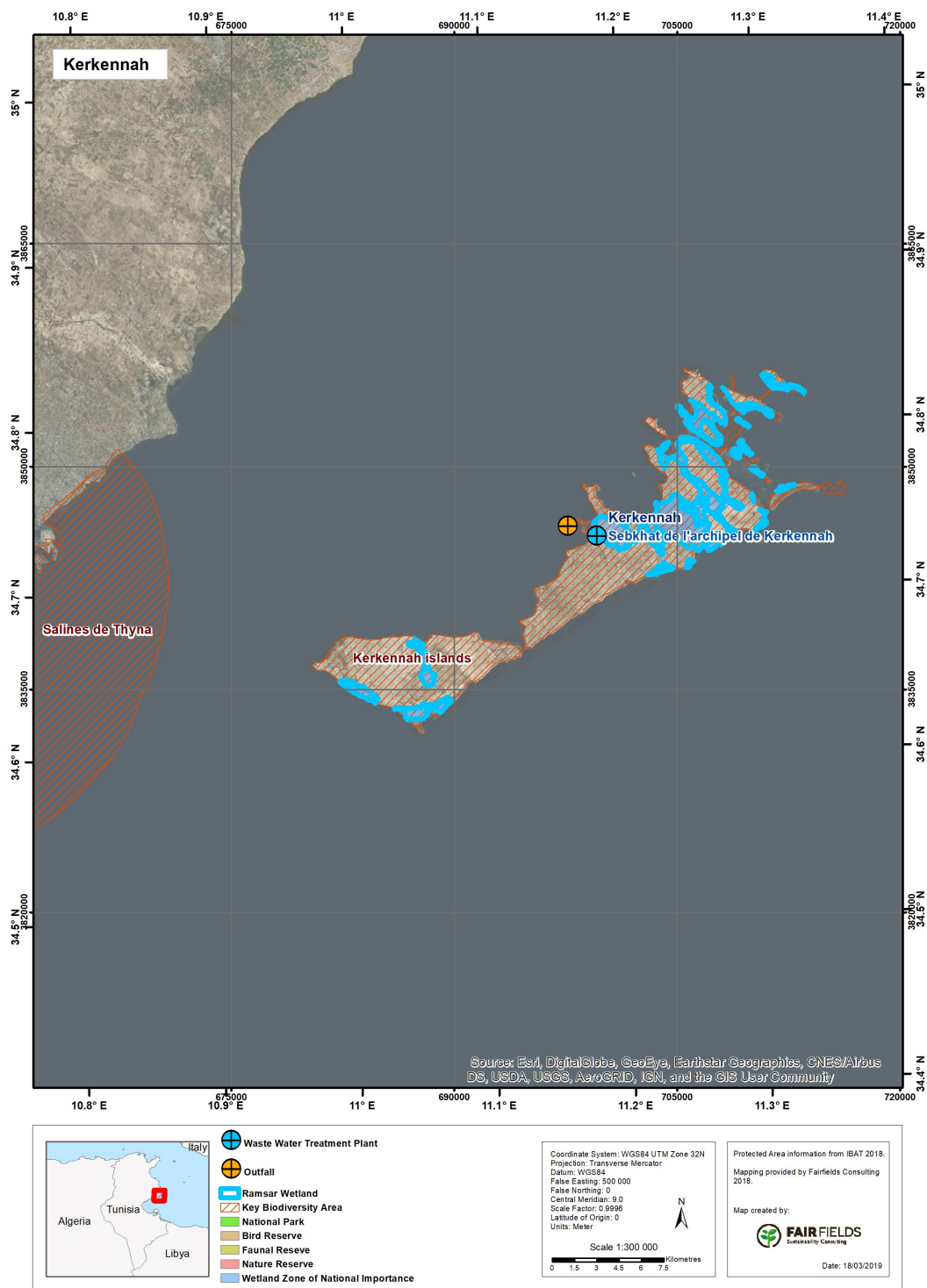


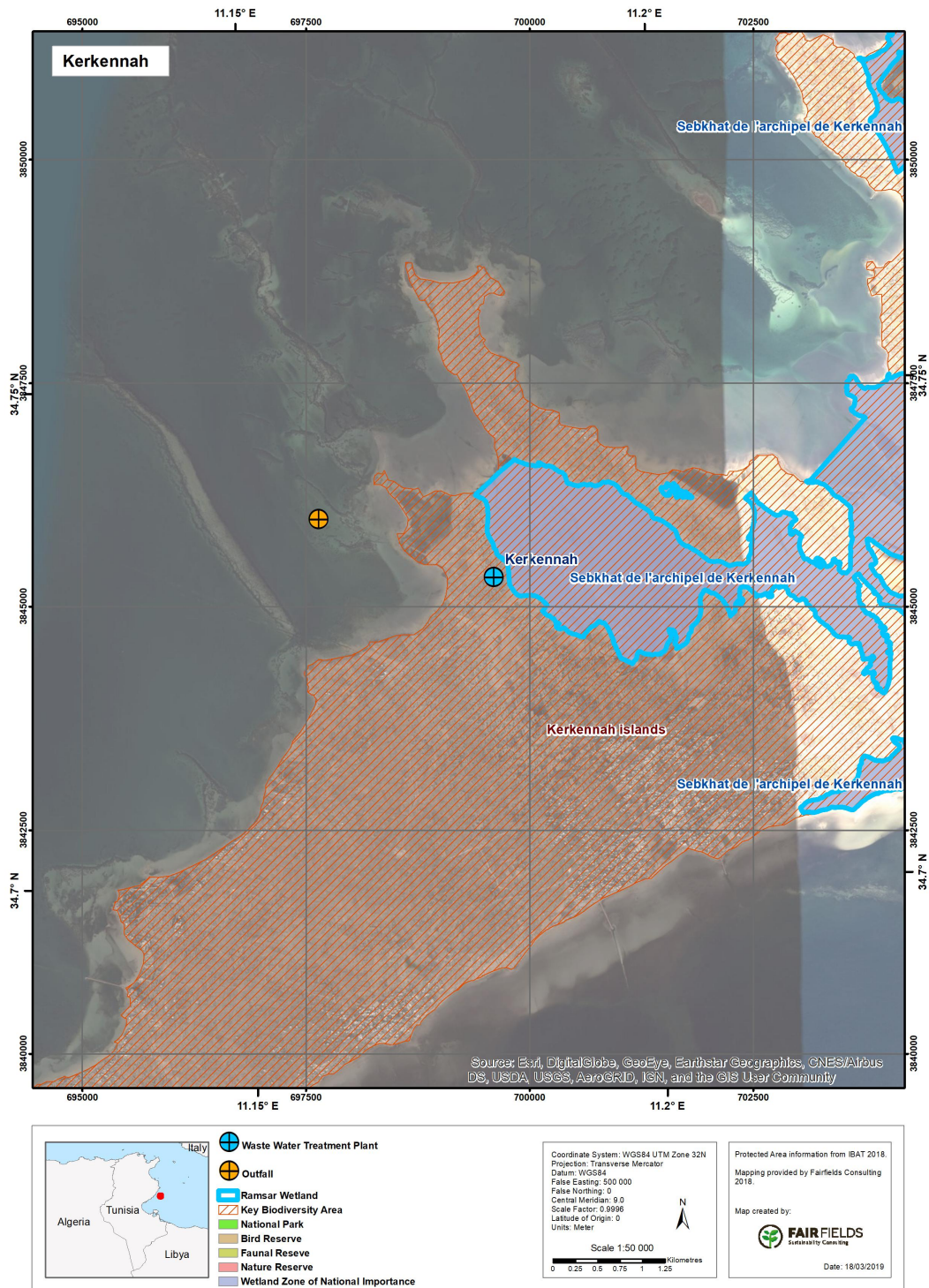
Jebeniana is a very small WWTP (1312m³/d hydraulic capacity) inland site. There are no indications of any IBA or Ramsar sites nearby, nor any sites of recognized importance. The WWTP is in an agricultural area with 100% Modified Habitat within 1 km. The outfall is within the Gulf of Gabès southwest of the WWTP (50% Modified Habitat, 50% Natural Habitat).

5.3.8.1 Conclusion

The primary concern is within the overall issue of the Gulf of Gabès and the need to evaluate impacts to the Gulf holistically and cumulatively as part of a CIA. We do not see the need for additional specific biodiversity work for the ESIA beyond the normal field surveys and analyses that would always be carried out.

5.3.9 Kerkennah





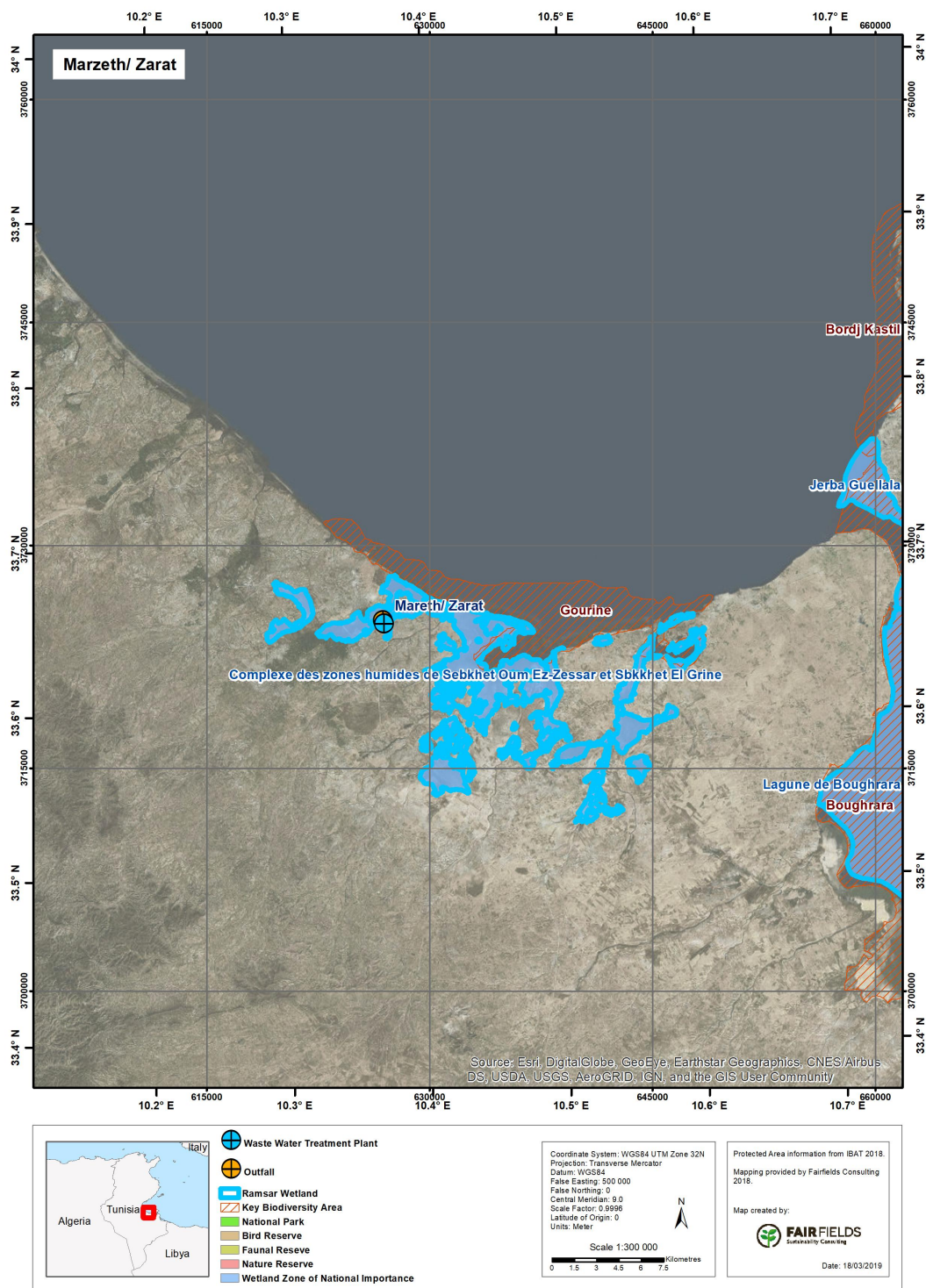
Kerkennah is a small WWTP (2700 m³/d hydraulic capacity) on the Kerkennah Islands. The entire island complex is considered an IBA and there is a Ramsar site about 5 km to the east. The islands do occasionally have Eurasian Spoonbill populations that meet the 1% global threshold. The WWTP is in Natural Habitat. There appears to be some habitat on the east within 1 km that might qualify as Critical Habitat as it could be used by the Eurasian Spoonbill. The outfall is out 800 m in the Gulf of Gabès and surrounded by 100% Natural Habitat.

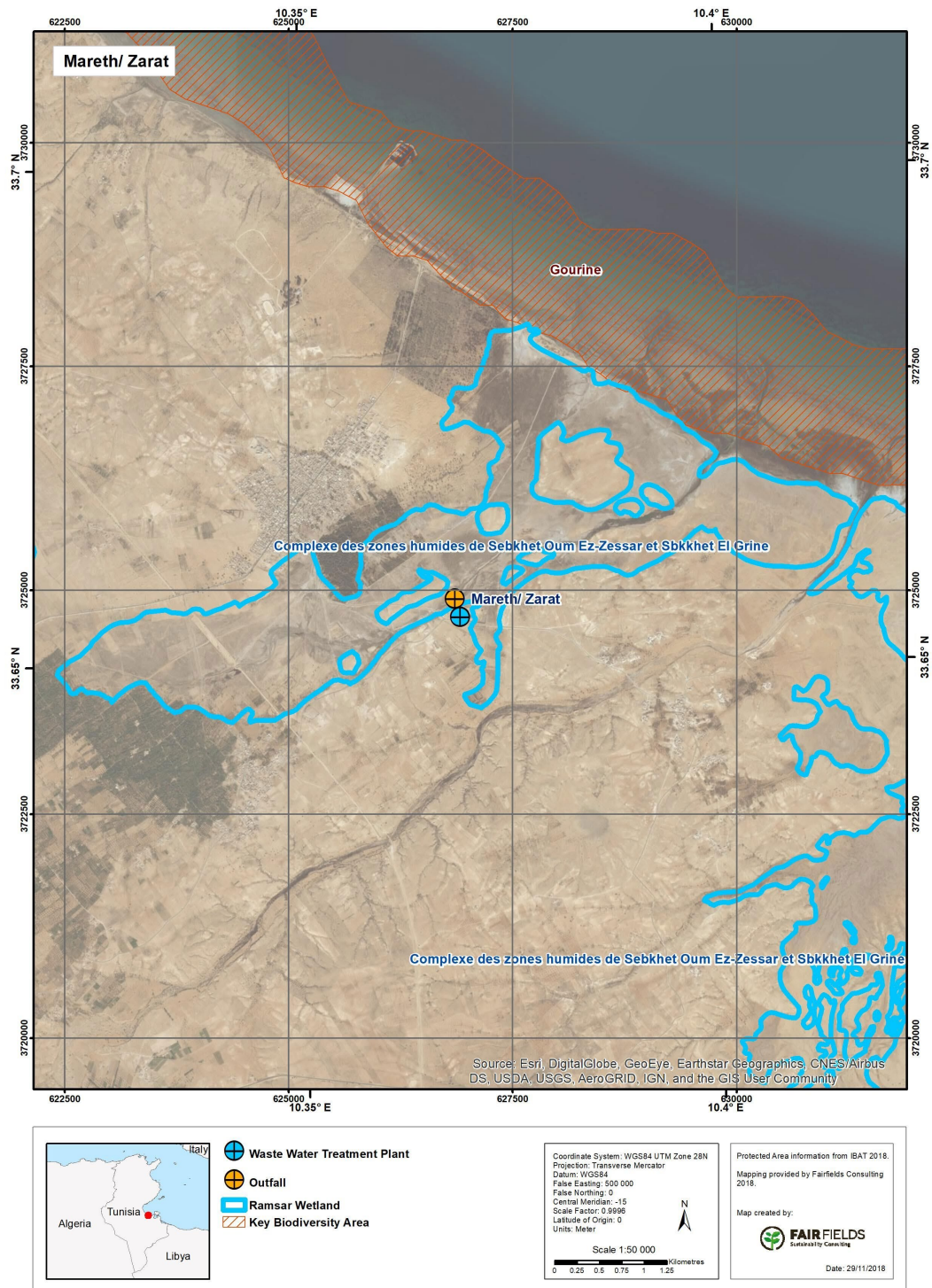
The Etude Environnementale Supplémentaire shows mixed conclusions about pollution concerns for the site. On the one hand it stresses that it is the only discharge point nearby and respects the national standard: “Etant donné que la STEP est la seule source d’eaux usées dans la zone et que le traitement se fait en respectant les normes nationales et qu’elle ne reçoit pas des EUI, les EUT ne peuvent pas constituer une importante menace pour le site ainsi que pour les oiseaux qui viennent séjourner dans les alentours.” However the ability of the currents to deal with the effluent is put into some doubt: “... la description du milieu récepteur a mis en évidence sa faible bathymétrie. L’émissaire mis en place pour le rejet des EUT de la STEP de 800 m de long ne permet pas d’assurer une dilution importante des EUT dans l’eau de mer. Toutefois, la dynamique des courants superficiels dont la circulation se fait de l’ouest vers l’est, c’est-à-dire de la côte vers le large assure une bonne dispersion des polluants rejetés dans les EUT et leur non-retour à la côte.”

5.3.9.1 Conclusion

We do not see the need for additional specific biodiversity work for the ESIA beyond the normal field surveys and analyses that would always be carried out. The site-specific ESIA must clarify the concerns about the dispersal of pollutants. A primary concern is within the overall issue of the Gulf of Gabès and the need to evaluate impacts to the Gulf holistically and cumulatively as part of a CIA. The CIA will also inform the adequacy of the Tunisian standards in this case.

5.3.10 Mareth / Zarat





Mareth is a small WWTP (2860 m³/d hydraulic capacity). The discharge is into a oued and then 3.5 km to the Gulf of Gabès. There is an IBA site (Gourine) at the point of discharge into the Gulf and a Ramsar site (Sebkheth Oum Ez-Zessar et Sebkheth El Grine) roughly 5 km to the east. Neither of these sites meet the IFC Criterion 3 threshold for Critical Habitat. The WWTP and outfall are in a mixed agricultural and natural area with roughly 70% Modified Habitat and 30% Natural Habitat within 1 km.

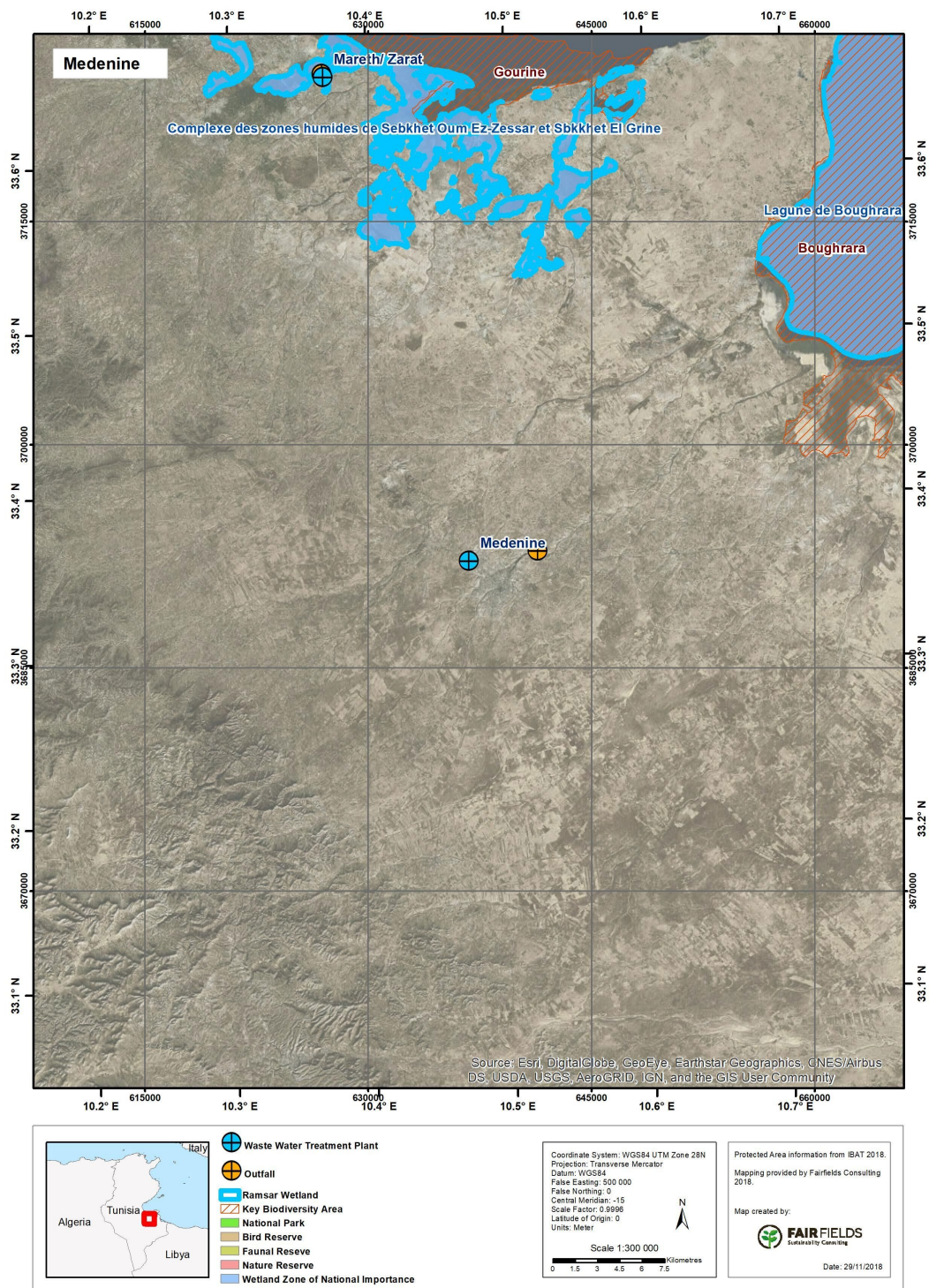
A key issue for this site is whether effluent from the discharge reaches the coast. The assumption that evaporation in the oued reduces the impact of the effluent remains to be proved and this should be a

key topic to be studied in the site-specific ESIA. Evaporation of the water in the effluent will lead to a concentrate of the substances of concern in the oued and therefore in the groundwater and/or the Gulf of Gabès. Evaporation is certainly an effective waste water treatment method but only when the evaporation occurs in a closed system and the residual effluent with high concentrations of various pollutants is retained and treated further. It is not clear how the evaporation of the water will reduce the amount of the other substances present.

5.3.10.1 Conclusion

We do not see the need for additional specific biodiversity work for the ESIA beyond the normal field surveys and analyses that would always be carried out. However, the fate of the effluent released to the oued needs to be further elaborated in the site-specific ESIA. This is one of the WWTP sites emptying into the Gulf of Gabès and to be subject to the CIA that will inform the adequacy of the standards for this site.

5.3.11 Medenine



Medenine is a medium WWTP (8870 m³/d hydraulic capacity) inland site. The discharge is into the Oued Gueblaoui (or Giblawi) and then 25 km to the Boughrara Lagoon. There is an IBA site (Boughrara) and a Ramsar site (Golfe de Boughrara) in the lagoon. The IBA site appears to meet the IFC Criterion 3 threshold for Critical Habitat for Slender-billed Gull.

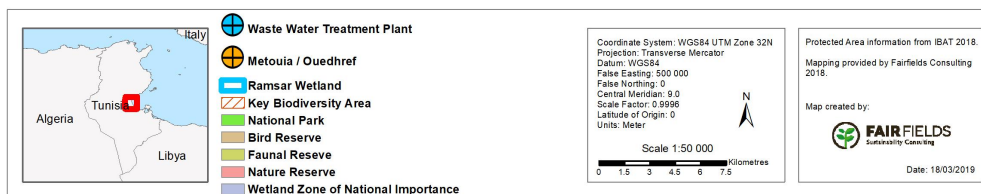
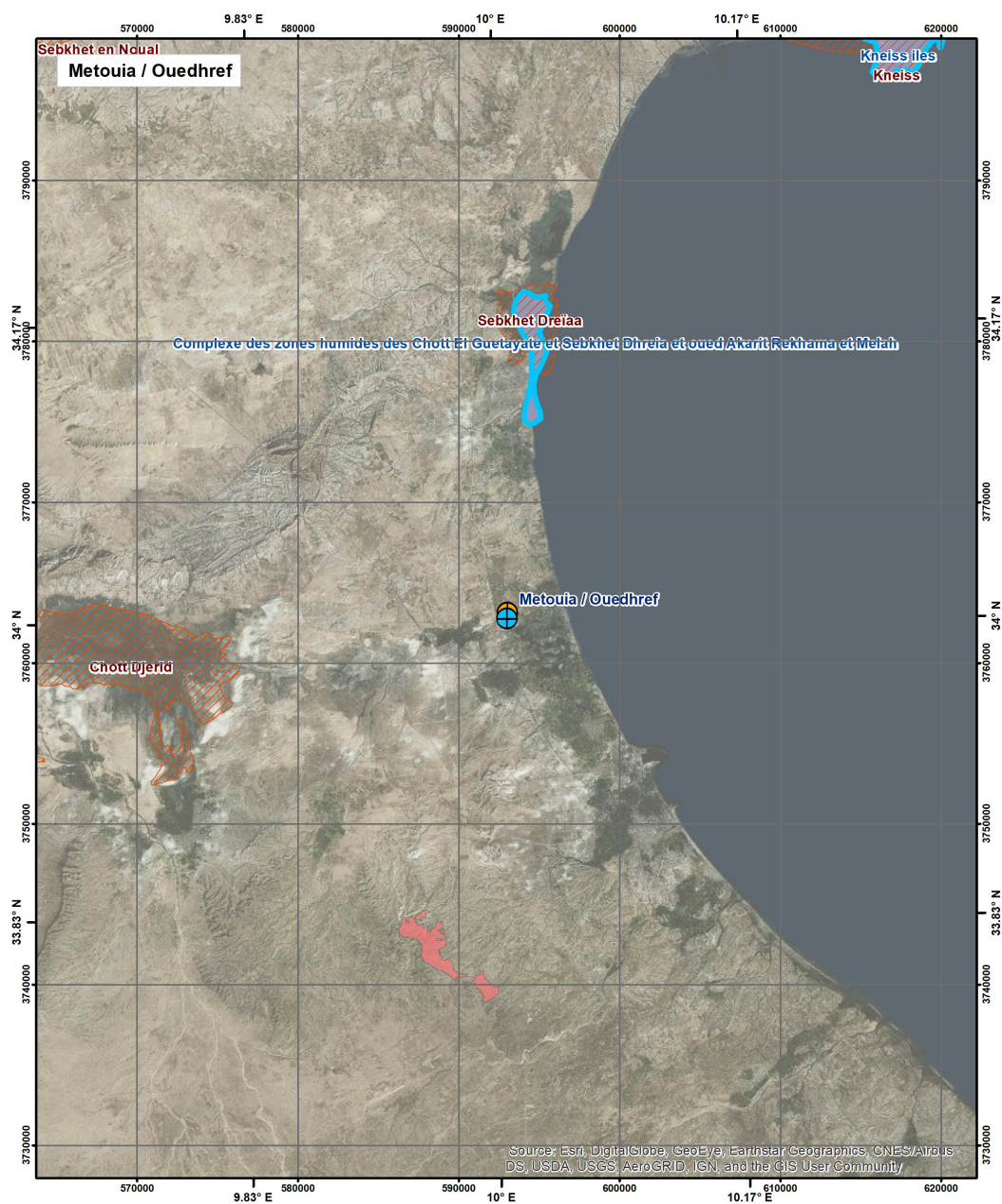
The WWTP and outfall are in a mixed agricultural and natural area with roughly 80% Modified Habitat and 20% Natural Habitat within 1 km. There is no indication of Critical Habitat close to the WWTP.

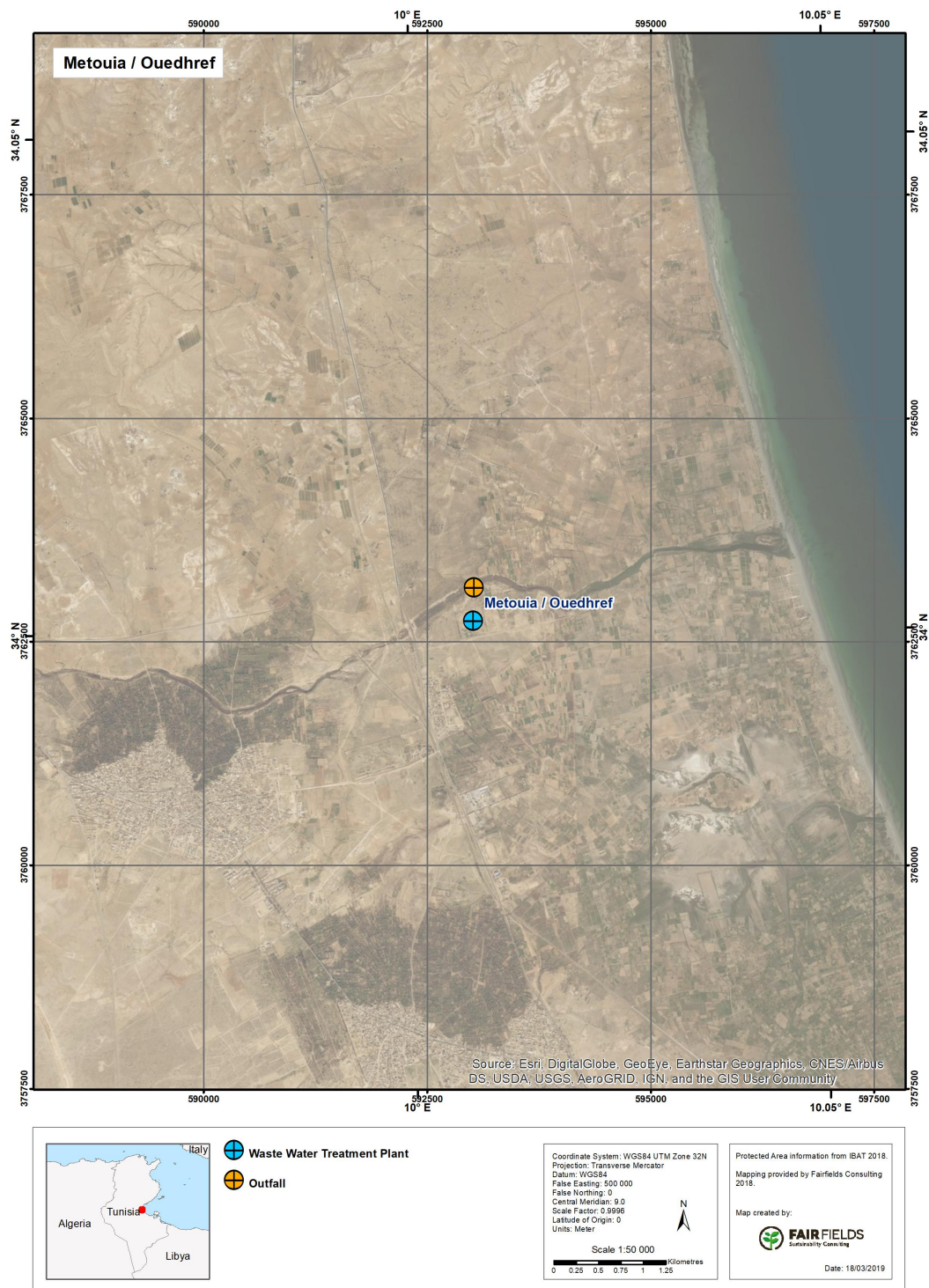
A key issue for this site is whether effluent from the discharge reaches the coast. As for Mareth, the assumption that evaporation in the oued reduces the impact of the effluent remains to be proved and this should be a topic to be studied in the site-specific ESIA. Evaporation of the water in the effluent will lead to a concentration of the substances of concern in the oued and therefore in the groundwater and/or the Gulf of Gabès. Evaporation is certainly an effective waste water treatment method but only when the evaporation occurs in a closed system and the residual effluent with high concentrations of various pollutants is retained and treated further. It is not clear how the evaporation of the water will reduce the amount of the other substances present. However, the distance here is much longer than for Mareth and the possibility of effluent substances reaching the coast is reduced.

5.3.11.1 Conclusion

We do not see the need for additional specific biodiversity work for the ESIA beyond the normal field surveys and analyses that would always be carried out. We also do not see the need for changes to the municipal sewage parameter levels of the “new” Tunisian standard.

5.3.12 Metouia / Ouethref





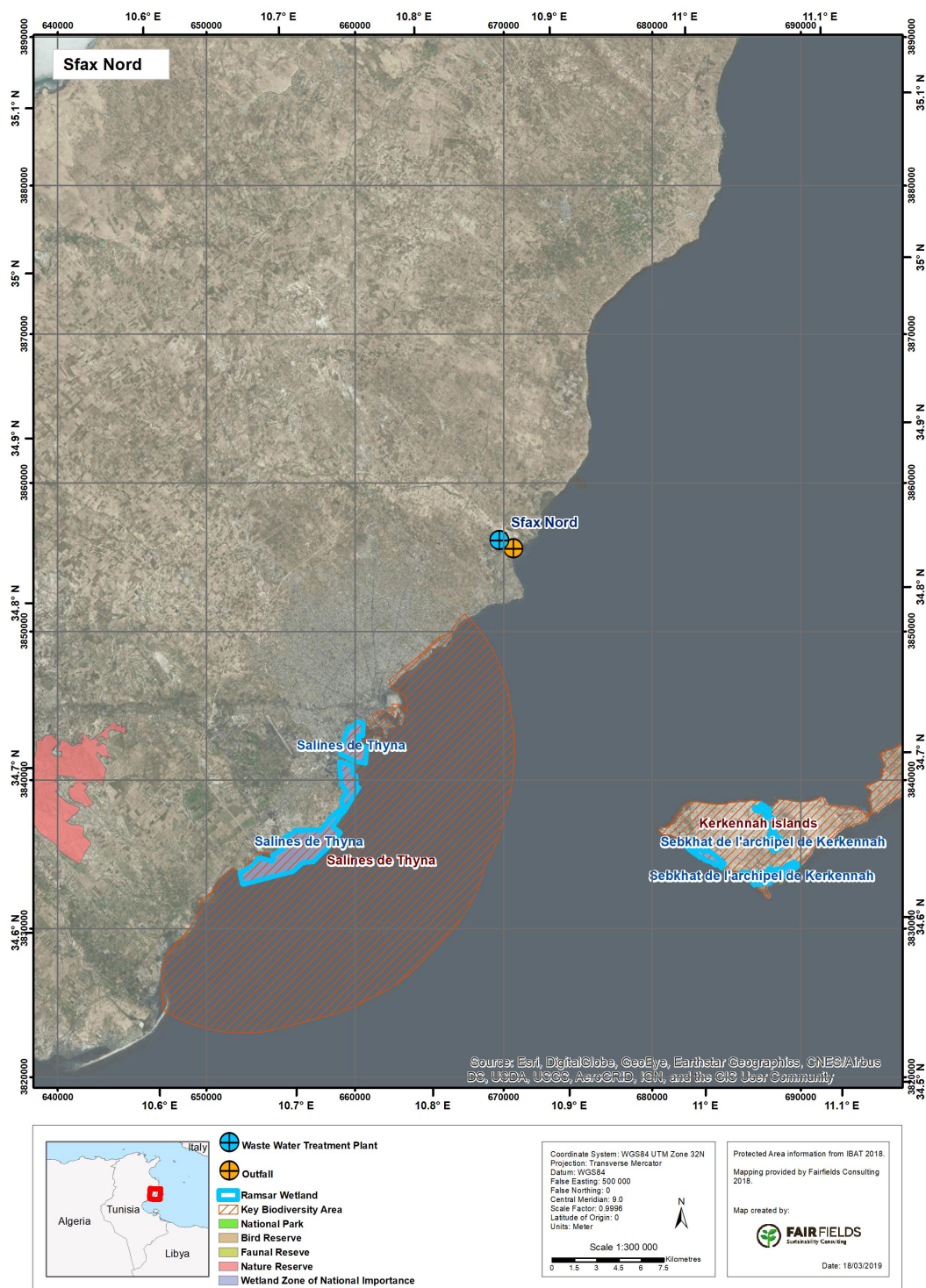
Metouia / Ouethref is a small WWTP (2860 m³/d hydraulic capacity) site. The discharge is into Oued Melah which then drains to the Gulf of Gabès 4 km to the east. There is a Ramsar site (Chott el Guetayate et Sebkheth Dhreia et Oueds Akarit, Rekhama et Meleh) at the point of discharge of the oued into the Gulf. The Ramsar site does not meet the IFC Criterion 3 threshold for Critical Habitat. The WWTP and outfall are in a mixed agricultural and natural area with roughly 80% Modified Habitat and 20% Natural Habitat within 1 km.

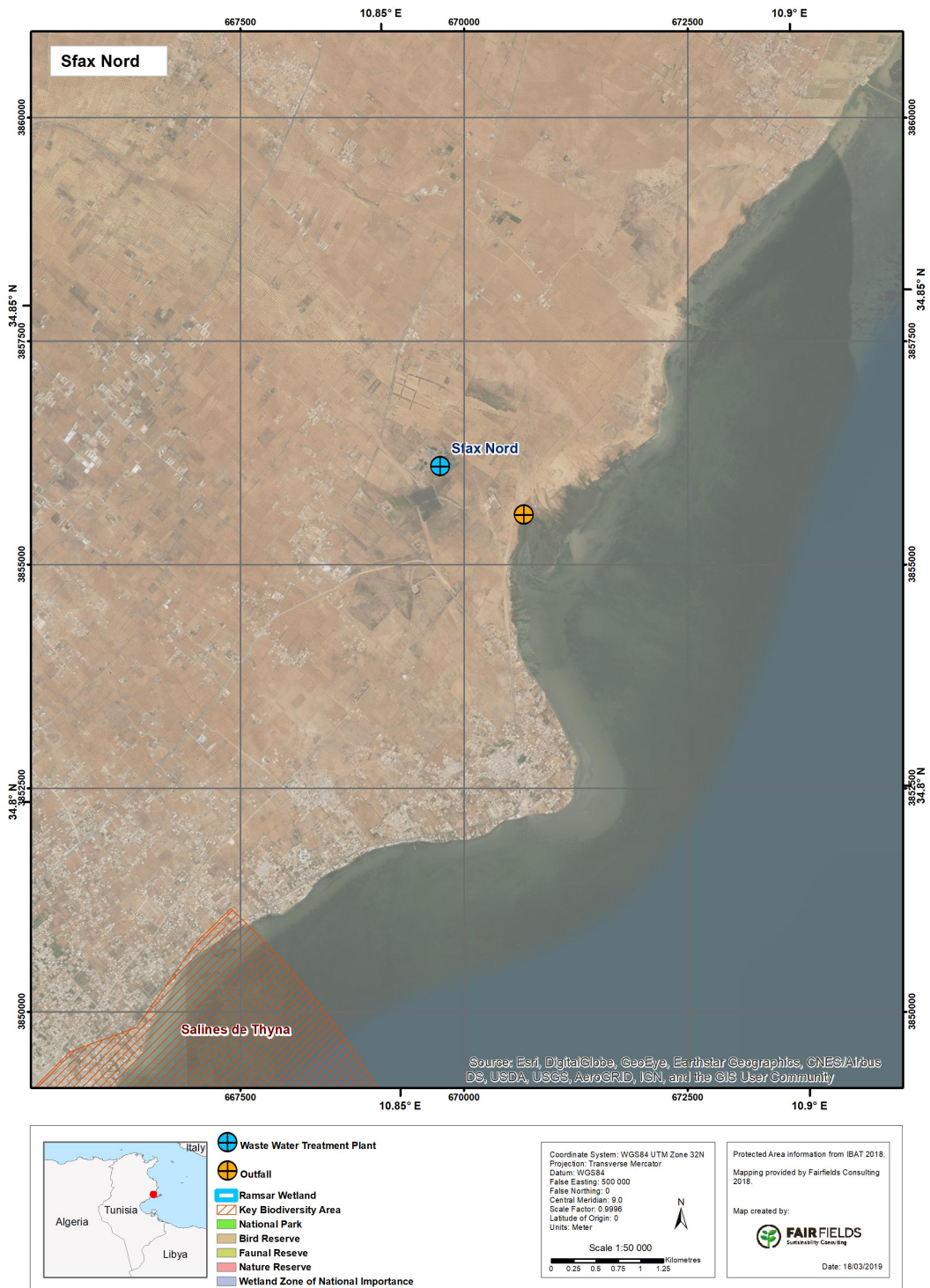
The situation is very similar to that of the Mareth site. Presumably the assumption is that evaporation in the oued reduces the impact of the effluent. This remains to be proved and this should be a key topic to be studied in the site-specific ESIA. Evaporation of the water in the effluent will lead to a concentrate of the substances of concern in the oued and therefore in the groundwater and/or the Gulf of Gabès. Evaporation is certainly an effective waste water treatment method but only when the evaporation occurs in a closed system and the residual effluent with high concentrations of various pollutants is retained and treated further. It is not clear how the evaporation of the water will reduce the amount of the other substances present.

5.3.12.1 Conclusion

We do not see the need for additional specific biodiversity work for the ESIA beyond the normal field surveys and analyses that would always be carried out. The issue of the adequacy of the standards should be informed by the CIA. The fate of the effluent released to the oued needs to be further elaborated in the site-specific ESIA.

5.3.13 Sfax Nord



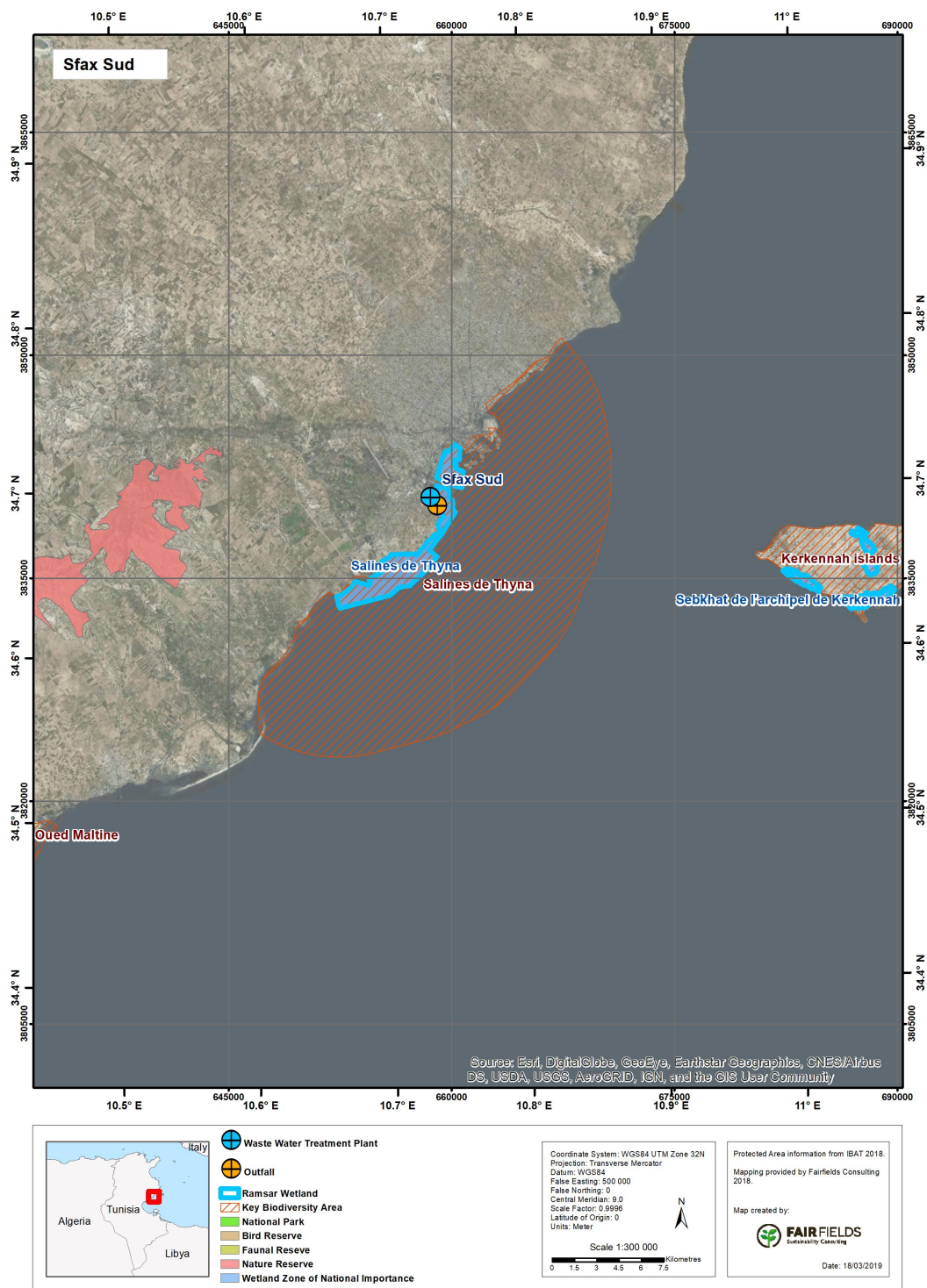


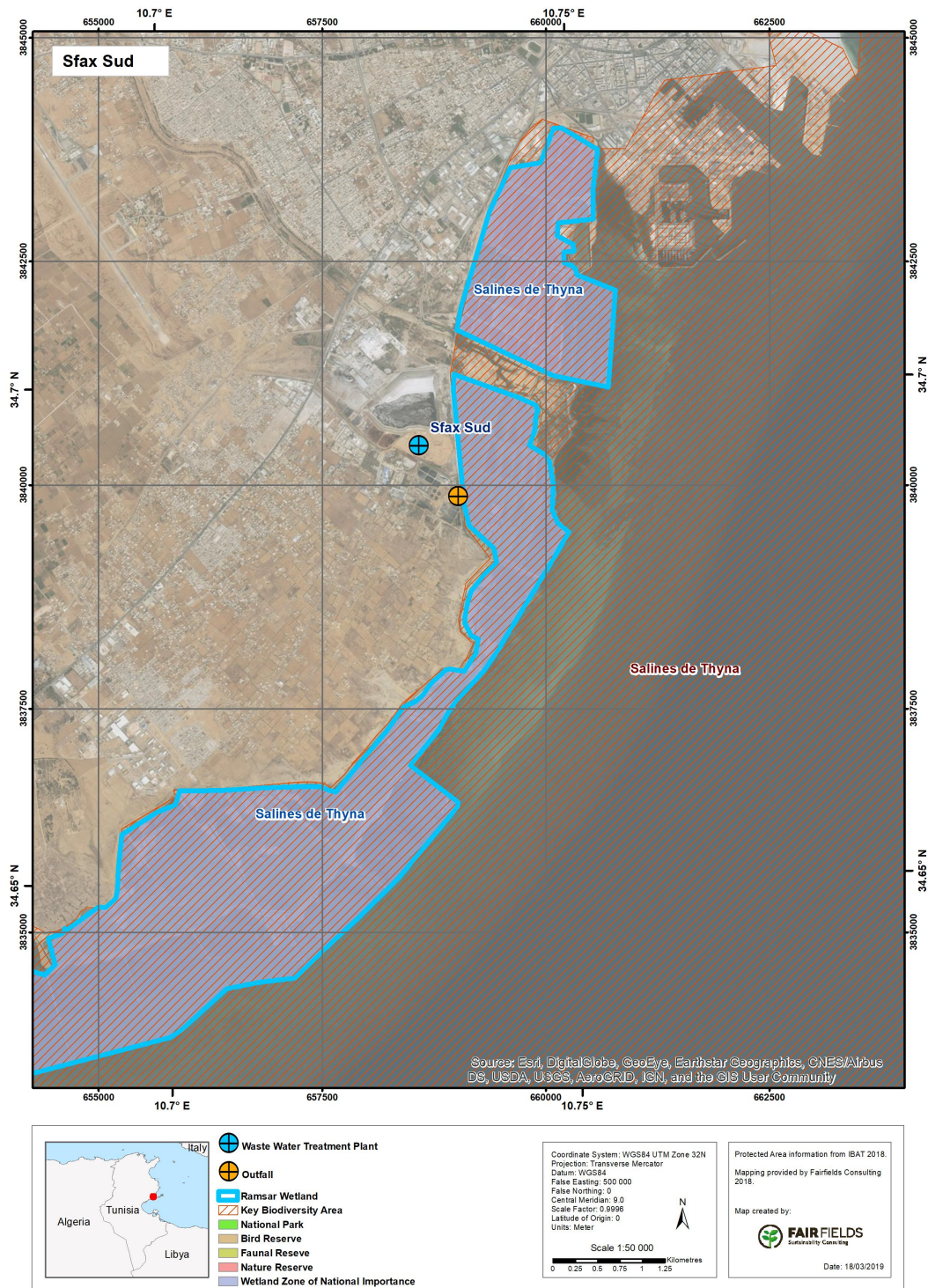
The Sfax Nord WWTP is a medium-sized WWTP (17,900 m³/d hydraulic capacity). It is located on the coast of the Gulf of Gabès, north of the town of Sfax. The outfall is via a 4km long pipe that goes out roughly 1 km into the Gulf. The Salines de Thyna is the closest IBA. The WWTP is in an agricultural area and there is 100% Modified Habitat within 1 km. The outfall in the Gulf and is therefore 100% Natural Habitat within 1 km.

5.3.13.1 Conclusion

We do not see the need for additional specific biodiversity work for the ESIA beyond the normal field surveys and analyses that would always be carried out. The issue of the adequacy of the standards should be informed by the CIA.

5.3.14 Sfax Sud





The Sfax Sud WWTP is the largest WWTP (49,500 m³/d hydraulic capacity). It is located on the coast of the Gulf of Gabès, on the southern edge of the town of Sfax. The outfall is about 300m east of the WWTP directly into a channel between the town and the Salines de Thyna. The Salines de Thyna include managed salt pans and are included in the Salines de Thyna IBA and Ramsar sites.

The IBA and Ramsar sites easily meet IFC PS6 Criterion 3 thresholds for Greater Flamingo and Slender-billed Gull. The sites are considered the second most important in the Gulf of Gabès for waders, after the Kneiss Islands.

The WWTP is located in Modified Habitat (industrial) and within 1 km it is mainly Modified Habitat (60%) but with a substantial part that is Critical Habitat (Natural Habitat) (40%). The outfall is roughly 50/50 within 1 km. The situation is quite complex. The WWTP is next to a phosphate plant. Contamination by mercury, lead, cadmium and radioactive elements occurs in both surface and ground water.

The *Etude Environnementale Supplémentaire* recognizes the problems of the Sfax Sud effluent:

“La STEP de Sfax Sud fournit une qualité médiocre des EUT avec un dépassement pour les Chlorures, DCO, DBO₅, MES, NtK, Pt, Sulfates, Al + Fe, Cyanures, Plomb, Mercure, Coliformes fécaux, Streptocoques fécaux, Salmonelles selon la Norme en vigueur et un dépassement des valeurs seuils de la DCO, DBO₅, MES, NtK, Pt, Pt, Cyanures, AL + Fe, Plomb, Zinc, Chrome hexavalent, Mercure, Coliformes fécaux, Streptocoques fécaux, Salmonelles lorsqu’on se base sur la nouvelle Norme. Après réalisation des travaux initiaux et complémentaires, la STEP de Sfax Sud, tout comme les autres STEP du périmètre de la concession, respectera les valeurs seuils concernant la DCO, la DBO₅, les MES, le NtK, le Pt et les paramètres biologiques. Toutefois, ces travaux n’agiront pas sur la réduction de la concentration en métaux lourds et autres polluants chimiques et organiques. Une partie de ces polluants a pour origine les EU domestiques mais les plus fortes concentrations sont dû aux rejets industriels ne respectant pas la Norme en vigueur pour les rejets en RPA. Etant donné que plus de 20% des rejets bruts traités au niveau de la station sont d’origine industrielle, il serait primordial de renforcer les contrôles des ouvrages de prétraitement des unités industrielles et de la qualité de leurs rejets.”

The assumption is that the upgrade works to be done at the WWTP will bring the effluent water quality up to the standard thresholds, but only for the traditional WWTP parameters, not for heavy metals and other parameters.

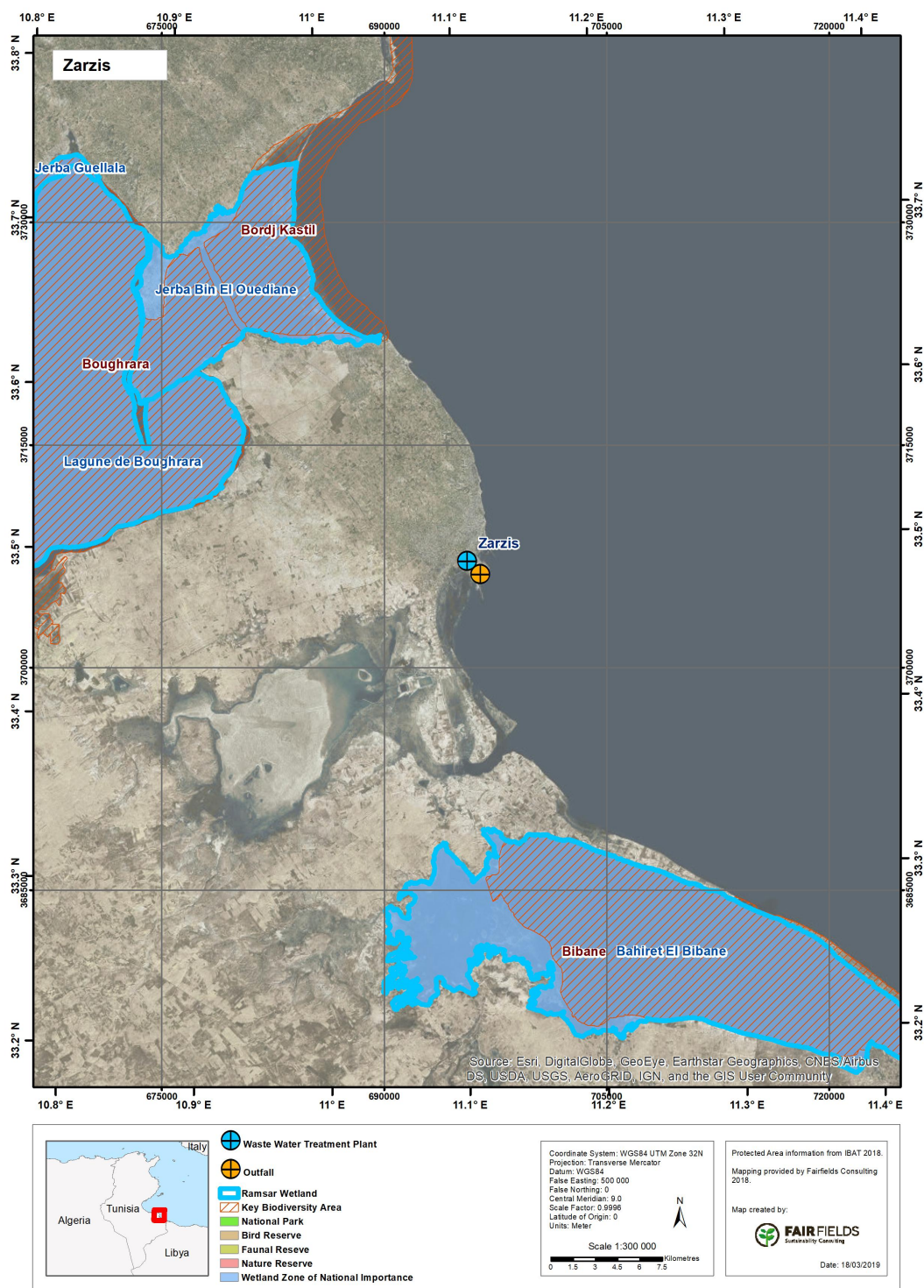
Even though the WWTP’s contribution to the Sfax area’s contamination is small compared to other sources, the issue cannot be ignored given that (a) the effluent output is possibly the most significant of any of the WWTP sites being considered, and (b) it is also next to one of the most significant natural areas, easily meeting the IFC Critical Habitat definition.

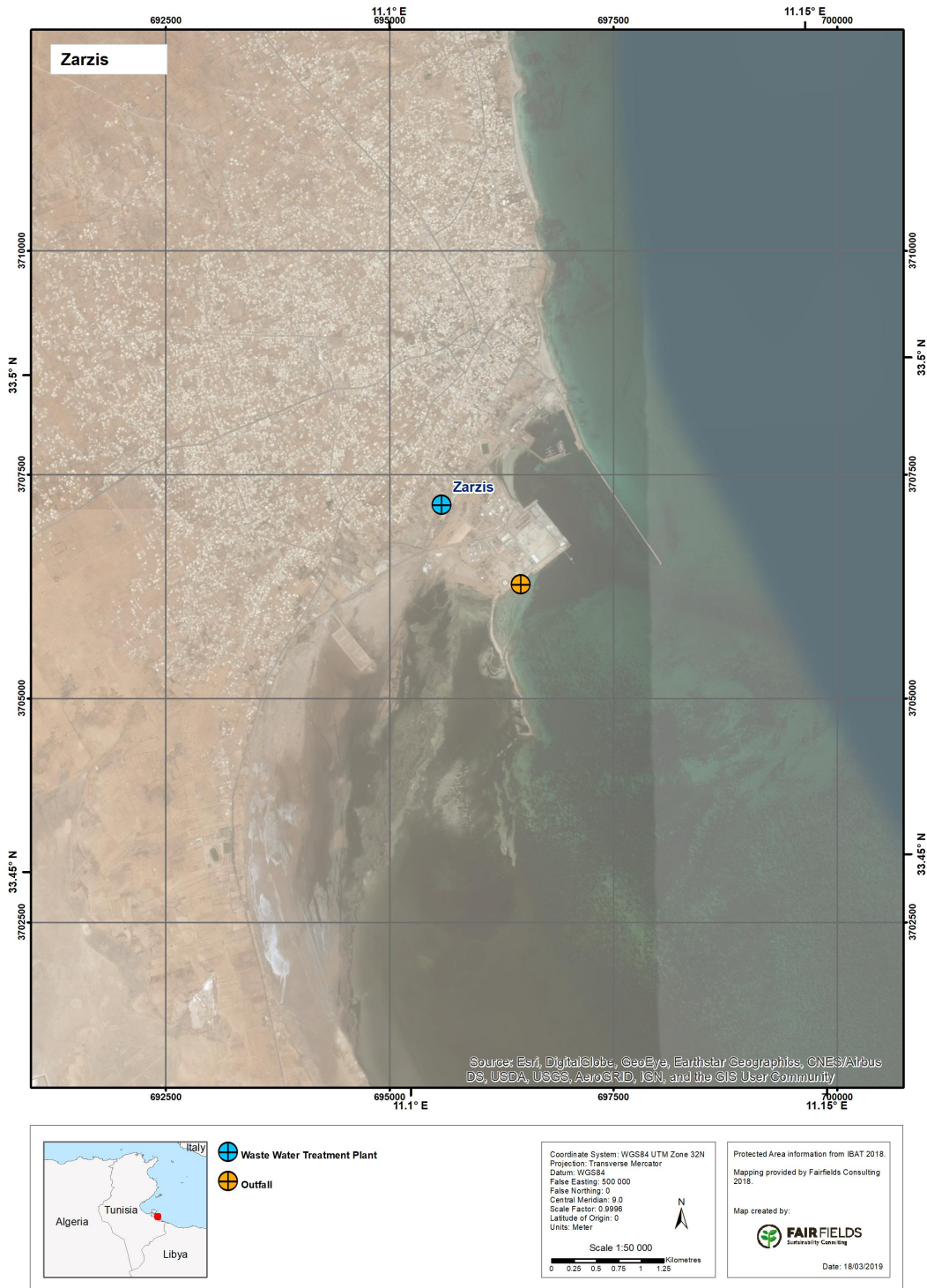
5.3.14.1 Conclusion

We see the need for additional specific biodiversity work for the ESIA beyond the normal field surveys and analyses that would always be carried out. The ESIA for this site needs to do some thorough fieldwork and analysis for the nearby sensitive sites.

The site is also of concern in terms of its impact on the Gulf of Gabès and the CIA will be needed to inform decisions regarding this site.

5.3.15 Zarzis Ville





The Zarzis Ville WWTP is a small WWTP (1,335 m³/d hydraulic capacity). It is located on the coast of the Mediterranean Sea, just east of Djerba Island. The outfall is on the shore about 1 km southeast of the WWTP.

There are no designated IBA or Ramsar sites close by. The closest sites are over 10 km away. The WWTP is in mixed residential / industrial area and there is 100% Modified Habitat within 1 km. The outfall is on the shore and is therefore 50% Natural Habitat and 50% Modified Habitat within 1 km.

Pomatoschistus tortonesei, Tortonese's goby (EN), is a marine fish with a range restricted to a few areas along the coast of Tunisia, adjacent Libya and Sicily. There is a small disjunct population east of Djerba Island and along to coast to Zarsis. It is unclear whether there might be a sufficient population within this restricted zone to meet the Criterion 1 threshold. We do not think that a specific search for this species is required as part of the site-specific ESIA in view of the difficulties associated with assessing the local population size. The issue is partly handled by the CIA that will take a broader look at a variety of issues, including the possibility of considering the Gulf of Gabès as being CH.

5.3.15.1 Conclusion

We do not see the need for additional specific biodiversity work for the WWTP-specific ESIA beyond the normal field surveys and analyses that would always be carried out. The site is of concern in terms of its impact on the Gulf of Gabès and the CIA will inform as to the adequacy of the Tunisian standards.

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7 Annexes

Annex 1 –Heavy metal Exceedances

Paramètre	Chlorures	DCO	DBO5	MES	Azote total	Nitrate	Nitrite	Phosphore total	Sulfate	cyanures	Aluminium+fer	Cadmium	Cobalt	Cuivre	Plomb	Manganèse	Nickel	Zinc	Chrome total	Chrome 6	Mercur	Coliformes fécaux	Streptocoques fécaux	Salmonelles	Vibrions cholériques	Œufs d'Helminthes
Unités	mg/l	mgO2/l	mgO2/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NPP/100 ml	NPP/100 ml	/100 ml	/100 ml	
Nouvelle Norme NT10602 Mars 2018 (DPH)	700	125	30	30	5	50	0.5	2	600	0.1	5 (Fer + Al)	0.01	0.5	2	0.1	1	0.2	5	0.5	0.05	0.005	2000	1000	Absence	Absence	
EI Hamma 2014	100 %	44%	89%	100 %	100 %	-	0%	100 %	33%	100 %	0%	-	-	-	-	-	-	0%	-	-	-	100%	100%	0%	0%	
EI Hamma 2015	14%	92%	92%	100 %	100 %	-	0%	14%	40%	0%	0%	-	-	0%	0%	0%	-	0%	-	-	0%	100%	100%	0%	0%	0%
EI Hamma 2016	100 %	100%	100%	100 %	100 %	0%	0%	100 %	100 %	0%	0%	-	-	-	-	0%	-	-	-	-	0%	100%	100%	0%	0%	0%
Gabes 2014	-	100%	100%	100 %	100 %	0%	0%	100 %	0%	100 %	0%	0	0	0	-	0%	-	0%	-	-	erreur 0%	100%	100%	0%	0%	
Gabes 2015	-	92%	100%	100 %	100 %	-	0%	100 %	20%	67%	0%	-	0%	-	0%	0%	-	0%	0%	-	erreur 100%	100%	100%	0%	0%	0%
Gabes 2016	-	100%	100%	100 %	100 %	0%	0%	100 %	75%	0%	0%	-	-	-	-	0%	-	0%	-	-	-	100%	100%	0%	0%	0%
Hencha 2014	20%	20%	40%	10%	100 %	-	0%	33%	0%	50%	0%	-	-	-	-	0%	0%	100 %	0%	0%	0%	100%	50%	0%	0%	
Hencha 2015	0%	0%	0%	0%	100 %	0%	100 %	43%	33%	0%	-	0%	-	-	-	0%	-	-	-	-	0%	75%	25%	0%	0%	0%
Hencha 2016	14%	0%	0%	29%	100 %	0%	25%	20%	60%	0%	0%	-	-	-	-	0%	-	-	-	-	0%	100%	50%	0%	0%	0%
Jebeniana 2014	30%	10%	10%	30%	100 %	-	25%	1%	0%	100 %	0%	-	-	-	-	0%	-	-	0%	0	-	100%	100%	0%	0%	

Paramètre	Chlorures	DCO	DBO5	MES	Azote total	Nitrate	Nitrite	Phosphore total	Sulfate	cyanures	Aluminium+fer	Cadmium	Cobalt	Cuivre	Plomb	Manganèse	Nickel	Zinc	Chrome total	Chrome 6	Mercur	Coliformes fécaux	Streptocoque s fécaux	Salmonelles	Vibrions cholériques	Oeufs d'Helminthes
Jebeniana 2015	18%	0%	0%	17%	100 %	0%	80%	29%	0%	0%	100%	0%	-	-	-	0%	-	-	-	-	50%	50%	50%	0%	0%	0%
Jebeniana 2016	67%	0%	17%	33%	100 %	0%	75%	80%	40%	0%	0%	-	-	-	-	0%	-	-	-	-	0%	50%	100%	0%	0%	0%
Jerba Aghir 2014	-	0%	0%	0%	50%	-	-	33%	0%	0%	0%	-	0%	0%	-	0%	-	-	-	-	-	33%	33%	0%	0%	
Jerba Aghir 2015	-	0%	0%	0%	29%	0%	0%	29%	0%	0%	0%	-	0%	-	-	0%	-	0%	-	-	-	25%	25%	0%	0%	0%
Jerba Aghir 2016	-	0%	0%	0%	17%	0%	0%	50%	60%	0%	-	0%	-	-	-	0%	-	-	-	-	0%	67%	67%	0%	0%	0%
Kerkennah 2014		10%	10%	50%	100 %	-	0%	100 %	0%	50%	-	-	-	-	-	0%	-	-	-	-	-	100%	100%	50%	0%	
Kerkennah 2015	-	100%	100%	80%	75%	0%	80%	100 %	0%	100 %	0%	-	-	0%	-	0%	-	0%	-	-	0%	100%	80%	0%	0%	0%
Kerkennah 2016	-	0%	43%	57%	100 %	0%	0%	80%	0%	0%	0%	-	-	0%	-	0%	-	-	-	-	0%	100%	100%	0%	0%	0%
Mareth 2014	50%	10%	40%	30%	100 %	0%	75%	50%	100 %	100 %	0%	-	-	-	-	0%	0%	0%	-	-	erreur 0%	100%	100%	0%	0%	
Mareth 2015	17%	42%	58%	67%	100 %	0%	33%	71%	40%	0%	0%	0%	0%	-	-	0%	-	0%	0%	-	0%	100%	100%	0%	0%	0%
Mareth 2016	0%	0%	0%	0%	100 %	0%	0%	20%	60%	0%	0%	-	-	-	-	0%	-	-	-	-	-	100%	100%	0%	0%	0%
Medenine 2014	100 %	0%	0%	0%	100 %	-	100 %	100 %	100 %	100 %	-	-	although Safx	-	-	0%	-	0%	-	-	100%	100%	100%	0%	0%	
Medenine 2015	50%	8%	8%	8%	86%	0%	20%	57%	100 %	50%	0%	0%	-	-	-	0%	0%	0%	0%	-	0%	100%	100%	0%	0%	0%
Medenine 2016	75%	43%	86%	100 %	100 %	0%	0%	80%	75%	0%	0%	-	-	-	-	0%	-	0%	-	-	0%	100%	100%	0%	0%	0%
Outheref 2014	100 %	100%	100%	100 %	100 %	-	0%	100 %	100 %	100 %	0%	100%	-	-	100 %	0%	0%	-	-	-	-	100%	100%	0%	0%	
Outheref 2015	100 %	100%	100%	100 %	100 %	-	0%	100 %	25%	0%	0%	-	0%	-	0%	0%	-	0%	-	-	erreur 0%	100%	100%	0%	0%	0%
Outheref 2016	100 %	0%	25%	0%	100 %	0%	0%	17%	100 %	0%	-	-	-	-	-	0%	-	-	-	-	-	100%	100%	0%	0%	0%
Sfax Nord 2014	-	0%	50%	50%	-	-	0%	100 %	50%	100 %	0%	-	-	-	-	0%	-	-	-	-	erreur 0%	100%	100%	50%	0%	

Paramètre	Chlorures	DCO	DBO5	MES	Azote total	Nitrate	Nitrite	Phosphore total	Sulfate	cyanures	Aluminium+fer	Cadmium	Cobalt	Cuivre	Plomb	Manganèse	Nickel	Zinc	Chrome total	Chrome 6	Mercur	Coliformes fécaux	Streptocoques fécaux	Salmonelles	Vibrions cholériques	Œufs d'Helminthes
Sfax Nord 2015	-	25%	33%	50%	57%	0%	0%	71%	0%	67%	0%	erreur 0%	-	-	-	0%	-	0%	-	-	100%	100%	100%	0%	0%	
Sfax Nord 2016	-	0%	0%	50%	67%	0%	0%	67%	50%	0%	0%	-	-	-	-	0%	-	-	0%	-	-	100%	100%	0%	0%	50%
Sfax Sud 2014		100%	100%	100%	100%	-	-	100%	0%	100%	50%		0%	0%	0%	0%	50%	0%	50%	-	erreur 0%	50%	0%	50%	0%	
Sfax Sud 2015	-	92%	100%	100%	100%	0%	0%	57%	17%	67%	33%	-	-	0%	0%	0%	0%	0%	0%	-	0%	100%	75%	0%	0%	0%
Sfax Sud 2016		10%	10%	50%	100%	-	0%	100%	0%	50%	-	-	-	-	-	0%	-	-	-	-	-	100%	100%	50%	0%	
Zarsis ville 2014	-	0%	20%	11%	100%	-	-	0%	0%	50%	50%	-	-	0%	-	-	0%	-	-	0%	0%	100%	100%	100%	0%	0%
Zarsis ville 2015	-	42%	33%	58%	71%	0%	0%	14%	20%	100%	100%	0%	0%	0%	-	0%	-	0%	-	-	0%	100%	25%	0%	0%	0%
Zarsis ville 2016	-	14%	50%	100%	100%	0%	0%	50%	75%	0%	0%	0	-	-	-	0%	-	-	-	-	0%	100%	100%	0%	0%	0%

Cells in yellow indicate values over 2x the new standard.